DANA SPICER®
Off-Highway Products

Service Manual

Transmission
TE13 & TE17 3-Speed Short Drop
with Full Flow Control Valve

TSM-0228
April 2013

CONTENTS

TOWING OR PUSHING

Before towing the vehicle, be sure to lift the driven axle wheels off the ground or disconnect the driveline to avoid damage to the transmission during towing.

NOTE:

Because of the design of the hydraulic system, the engine cannot be started by pushing or towing.

INTRODUCTION

Foreword

This manual has been prepared to provide the customer and maintenance personnel with information and instructions on the maintenance and repair of Dana Spicer products.

Extreme care has been exercised in the design, selection of materials, and manufacturing of these units. The slight outlay in personal attention and cost required to provide regular and proper lubrication, inspection at stated intervals, and adjustments as indicated will be reimbursed many times in low cost operation and trouble-free service.

In order to become familiar with the various parts of the product, its principle of operation, troubleshooting, and adjustments, it is urged that mechanics study the instructions in this manual carefully and use it as a reference when performing maintenance and repair operations.

Whenever repair or replacement of component parts is required, only Dana Spicer approved parts, as listed in the applicable service parts list, should be used. Use of “will fit” or non-approved parts may endanger proper operation and performance of the equipment. Dana does not warrant repair, replacement parts, or failures resulting from the use of parts which are not supplied or approved by Dana.

IMPORTANT:

ALWAYS FURNISH THE DISTRIBUTOR WITH THE SERIAL AND MODEL NUMBER WHEN ORDERING PARTS.

Safety Precautions

To reduce the chance of personal injury and/or property damage, the following instructions must be carefully observed. Proper service and repair are important to the safety of the service technician and the safe, reliable operation of the machine. If replacement parts are required, the part must be replaced with a Dana specified replacement part. NEVER use a replacement part of lesser quality.

The service procedures recommended in this manual are effective methods of performing service and repair. Some of these procedures require the use of unique tools. Accordingly, anyone who intends to use a replacement part, service procedure, or tool, which is not recommended, must first determine that neither their safety or the safe operation of the machine will be jeopardized by the replacement part, service procedure, or tool selected.

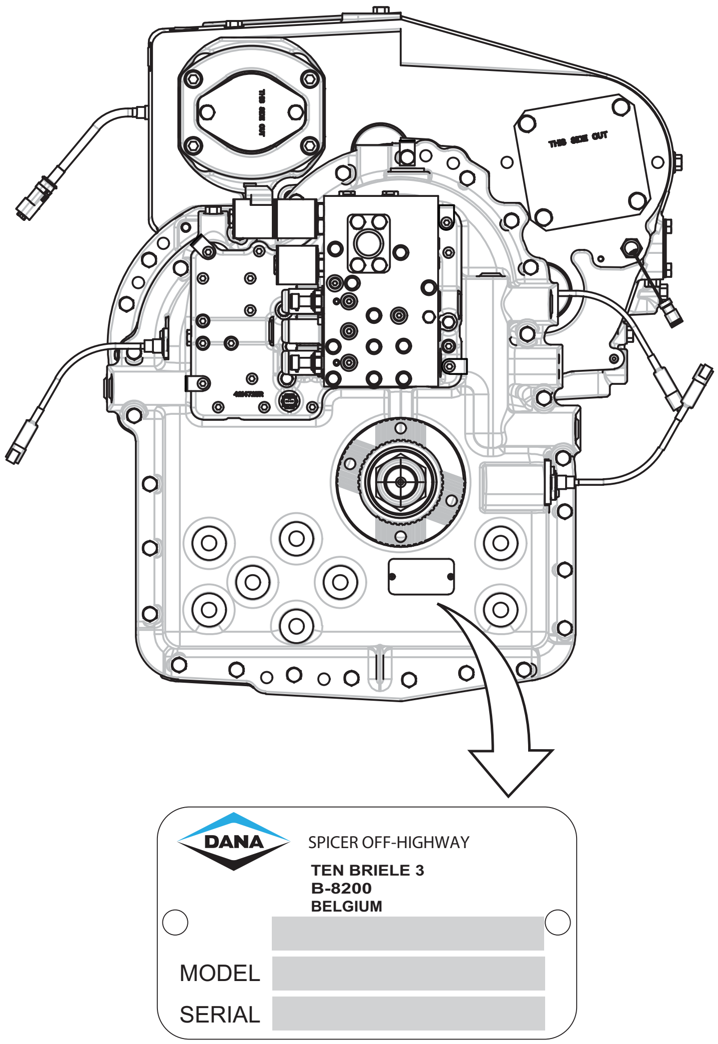
It is important to note that this manual contains various precautions that must be carefully observed in order to reduce the risk of personal injury during service or repair. Improper service or repair may also damage the unit or render it unsafe. It is important to understand that these precautions are not exhaustive. It is impossible to warn of all possible hazardous consequences that may result from following or failing to follow these instructions.

⚠ DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor injury.
NOTICE	Indicates a situation which, if not avoided, may result in damage to components.

SPECIFICATIONS

Identification Tag

The nameplate contains both the model and serial number of the unit.



General Specifications

Weight (dry)	± 1257 lbs / 570 kg
Length (maximum)	41.14” / 1045 mm
Width (maximum)	27.28” / 693 mm
Height (maximum)	32.53” / 826 mm
Oil Capacity	+ 6.6 US gallons / 25 liters*

* *Without cooler and hydraulic lines. Consult equipment operator’s manual for complete system capacity.*

Hydraulic Cooler Lines Specifications

Lines and Fittings (Minimum)	0.75” / 19 mm internal diameter
Continuous Operating Temperature	ambient to 248°F / 120°C
Continuous Pressure	435 PSI / 30 bar continuous pressure and 652 PSI / 45 bar intermittent surges
Conformance	SAE J1019 and SAE J517, 100RI

Pressure and Temperature Specifications

Normal Operating Temperature	158-248ºF / 70-120ºC Measured at temperature check port for cooler
Maximum Temperature	248ºF / 120ºC
Regulator Pressure*	Vehicle in Neutral & Port 31* At 600 RPM minimum: 377 PSI / 26 bar minimum At 2650 RPM: 450 PSI / 31 bar maximum
Pump Flow*	At 2200 RPM 24.3 GPM / 92.1 l/min minimum
Clutch Pressure*	1st clutch: Port 41* 2nd clutch: Port 42* 3rd clutch: Port 43* Forward clutch: Port 45* Reverse clutch: Port 46* At 2200 RPM: 377-435 PSI / 26-30 bar clutch activated 0-3 PSI / 0-0.2 bar clutch released
Filter Bypass Valve*	Set at 65.2 PSI / 4.5 bar
Lube Pressure*	Port 33 22.5-32.6 PSI / 1.55-2.25 bar at 16.9 GPM / 64 l/min converter flow ±1500 RPM
Safety Valve Cracking Pressure*	108.7 PSI / 7.5 bar
Converter Out Pressure*	Port 32 Pressure between 43.5-50.7 PSI / 3-3.5 bar when transmission is stalled at full throttle and engaged in Fwd / 3rd gear

* *All pressures and flows to be measured with oil temperature 180-200°F / 82-93°C.*

Electrical Specifications

Proportional Valves	FWD/REV - 1st/3rd - 2nd Coil Resistance: 7.25Ω at 68°F / 20°C
Selection Valves	FWD/N/REV - 1st/3rd Coil Resistance: 28.5Ω at 68°F / 20°C
Speed Sensor	Type: Magneto resistive sensor Sensing Distance: 0-0.07" / 0-1.8 mm Sensor Signal: Generates a square current with a fixed amplitude changing between 7 and 14 mA.
Temperature Sensor	Material: Silicon Resistance: 77°F / 25°C = 2000Ω ± 1%
Pressure Sensor	Supply Voltage: 4.5-5.5V Maximum Current: 10mA Pressure Range: 14.5-450 PSI / 1-31 bar ± 1.2% full scale (450 PSI / 31 bar) range 14.5-363 PSI / 1-25 bar ± 2.5% full scale (450 PSI / 31 bar) range 363-450 PSI / 25-31 bar

Temperature Sensor

Ambient Temperature °C	**Resistance** Ω
-50	1040
-30	1250
-10	1500
10	1770
25	2000
30	2090
50	2400
70	2800
90	3180
110	3630
130	4050
150	4490

MAINTENANCE

Sump preheaters

Preheat the transmission fluid to the minimum temperature for the oil viscosity used before engine start up.

Filters

Service oil filter elements the first time at 100 hours and then every 1000 hours under normal environmental and duty cycle conditions.

Clutch Calibration

Perform automatic clutch calibration every 2000 hours.

Lubricants

Recommended Lubricants

Only Dextron® III is approved. Viscosity at 104°F [40°C] = 33 - 38 cSt; at 212°F [100°C] = 7-8 cSt.

Maintenance Intervals

Daily

Check oil level daily with engine running at idle (600 RPM) and oil at 180-200°F [82 - 93°C].

Maintain oil level at full mark.

Normal oil change interval

Drain and refill system every 1000 hours for average environmental and duty cycle conditions. Severe or sustained high operating temperature or very dusty atmospheric conditions will result in accelerated deterioration or contamination. Judgement must be used to determine the required change intervals for extreme conditions.

Every 1000 hours:

- Change oil filter element.
- Drain oil at 150–200°F [65-93°C] and refill system as follows:

1. Drain transmission.
2. Remove and discard filter.
3. Install new filter.
4. Refill transmission to FULL mark.
5. Run engine at 500 - 600 RPM to prime converter and lines.
6. Recheck level with engine running at 500 - 600 RPM and add oil to bring level to LOW mark. When oil temperature is hot 180-200°F [82.2-93.3°C] make final oil level check and adjust if necessary to bring oil level to FULL mark.

NOTE:

It is recommended that oil filter be changed after 100 hours of operation on new, rebuilt, or repaired unit.

Extended oil change interval

Extended oil service life may result when using synthetic fluids. Appropriate change intervals should be determined for each transmission by measuring oil oxidation and wear metals, over time, to determine a baseline. Wear metal analysis can provide useful information but a transmission should not be removed from service based solely on this analysis.

Servicing Machine After Component Overhaul

The transmission, torque converter, and its allied hydraulic system are important links in the driveline between the engine and the wheels. The proper operation of either unit depends greatly on the condition and operation of the other. Therefore, whenever repair or overhaul of one unit is performed, the balance of the system must be considered before the job can be considered complete.

After the overhauled or repaired transmission has been installed in the machine, the oil cooler, and connecting hydraulic system must be thoroughly cleaned. This can be accomplished in several manners and a degree of judgement must be exercised as to the method employed.

The following are considered the minimum steps to be taken:

1. Drain entire system thoroughly.
2. Disconnect and clean all hydraulic lines. Where feasible hydraulic lines should be removed from machine for cleaning.
3. Replace oil filter element.
4. The oil cooler must be thoroughly cleaned. The cooler should be “back flushed” with oil and compressed air until all foreign material has been removed. Flushing in direction of normal oil flow will not adequately clean the cooler. If necessary, cooler assembly should be removed from machine for cleaning, using oil, compressed air, and steam cleaner for that purpose.

IMPORTANT:

NEVER use flushing compounds for cleaning purposes.

5. Reassemble all components and use only type oil (See chapter 4.1.1 “Recommended lubricants”).
   Fill the transmission through filler opening until fluid comes up to FULL mark on transmission dipstick.

- Remove filler plug and fill oil until FULL mark.
- Run engine two minutes at 500 - 600 RPM to prime torque converter and hydraulic lines.
- Recheck level of fluid in transmission with engine running at idle (500 - 600 RPM).
- Add quantity necessary to bring fluid level to LOW mark on dipstick.
- Recheck with hot oil 180 – 200°F [82.2 - 93.3°C].
- Adjust oil level to FULL mark on dipstick.

6. Recheck all drain plugs, lines, connections, etc… for leaks and tighten where necessary.
7. Perform automatic calibration.

Automatic Calibration Procedure

Introduction

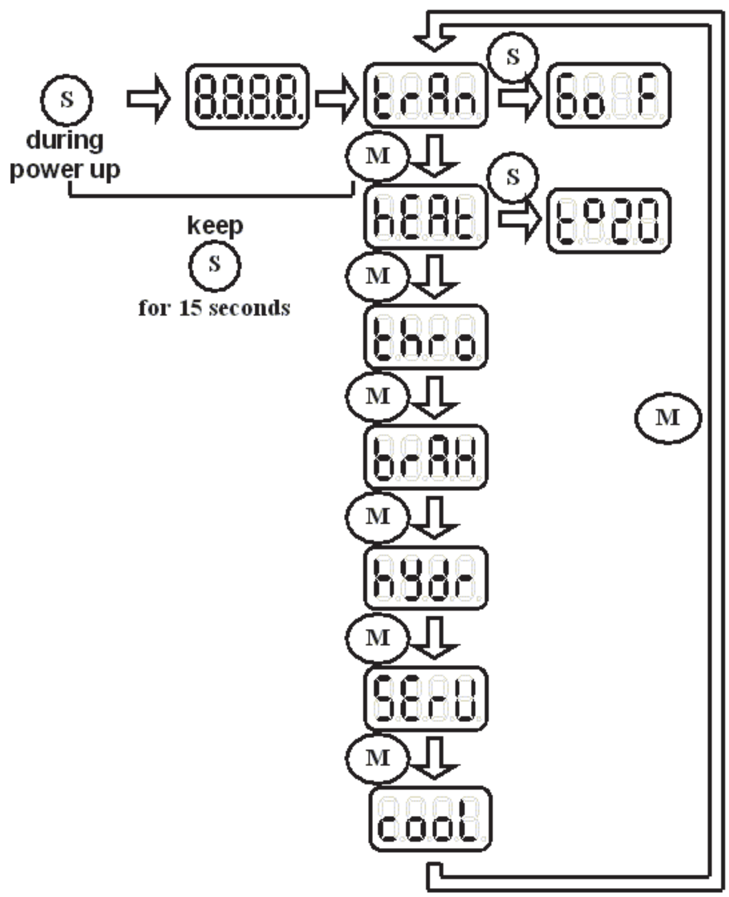
The APC200 firmware contains an automatic transmission calibration procedure, which is able to optimize the shift quality of the transmission.

An automatic calibration has to be done:

- When the vehicle is build at the OEM
- Every 2000 hours of transmission operation
- When an overhaul of the transmission is done
- When the transmission is repaired
- When the APC200 is replaced

ENTERING AUTOMATIC CALIBRATION MODE

The automatic calibration mode is entered by pressing the S-button on the APC200 display for 15 seconds during power-up.

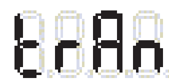


PERFORMING AUTOMATIC CALIBRATION

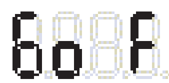
Before the automatic calibration can be started, a number of conditions need to be fulfilled:

- The parking brake on the vehicle has to be activated.
- The transmission temperature needs to be above 60°C. See the next paragraph how to use the 'HEAT'-mode to do this in a time effective way.
- The engine speed has to be kept at around 800 rpm (± 200 rpm) during the complete calibration. If the APC200 has control over the engine, the engine speed will be adapted automatically.

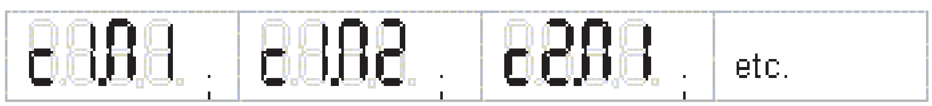
1. If all the conditions mentioned above are met, the actual automatic calibration can be performed starting from the following display on the APC200:



2. To trigger the automatic calibration procedure, push the S-button once. The APC200 display readout will show:

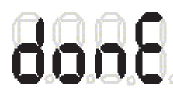


3. The APC200 asks for the shift lever to be put in FORWARD.
The automatic transmission calibration procedure starts. This is indicated on the APC200 display:



'C1' stands for 'clutch 1' being forward, while 'M1' stands for 'mode 1' of the calibration.

4. When all clutches have been calibrated, the APC200 displays:



5. At this point, the automatic calibration has completed successfully. The normal duration of a complete transmission calibration is around 15 minutes.

6. To exit the automatic calibration mode, switch off the vehicle ignition key. Make sure that the APC200 has powered down – wait for 2 seconds. Now restart the vehicle and the new tuning results will be activated automatically.

Troubleshooting

If anything different than described above appears on the APC200 display, there can be two possible reasons:

- The calibration conditions are not fulfilled (temperature is too low, parking brake switched off, the vehicle is moving, engine rpm is too high or too low).
- A calibration error has occurred during the calibration. This message starts with an 'E' (see "CALIBRATION CONDITION MESSAGES AND CALIBRATION ERRORS", on page 18).

By selecting REVERSE on the shift lever, while the automatic calibration is performing, the procedure will abort the automatic calibration immediately and restart the APC200. This feature can be used when something goes wrong during the calibration procedure.

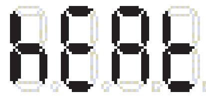
NOTE:

By aborting the automatic calibration, the calibration is not finalized and needs to be done from the beginning.

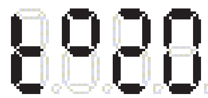
HEATING UP THE TRANSMISSION BY USING THE ‘HEAT’-MODE

The ‘HEAT’-mode allows to select forward / reverse while the parking brake is activated, without forcing neutral and will disable the inching and declutch function. During the heat mode the highest gear is forced – even when the shift lever is in a lower gear. This combination allows the driver to heat up the transmission by going into stall.

‘HEAT’-mode can be activated in the same way automatic calibration mode is entered (see “ENTERING AUTOMATIC CALIBRATION MODE”, on page 15). Once “tran” is displayed on the screen, press the M-button once to go into the “HEAT”-mode. The APC200 will display:



To trigger the ‘HEAT’-mode, push the S-button. The APC200 will display the sump temperature:

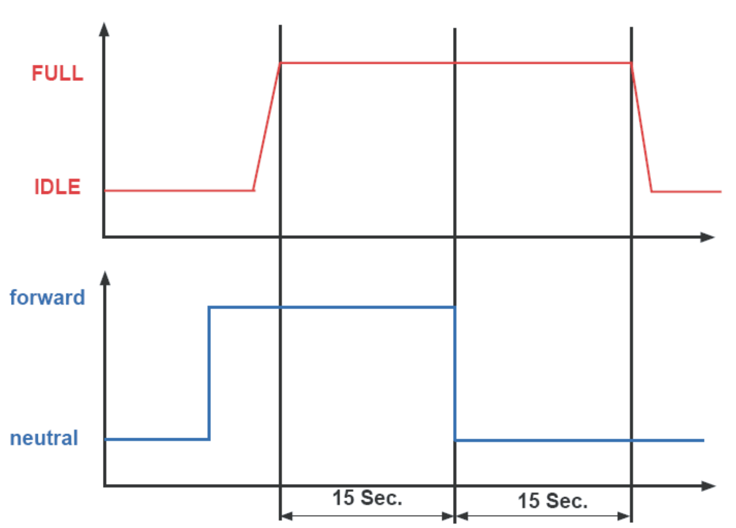


This means the actual sump temperature of the transmission is 20°C.

Perform the following steps in order to heat up the transmission:

1. Make sure the parking brake is active and works properly.
2. Put the transmission in forward by selecting forward with the shift lever and then accelerates the engine to full throttle.
3. Keep the engine at full throttle for about 15 seconds and then put the gearbox in neutral by selecting neutral with the shift lever. Keep the engine at full throttle!
4. Keep the gearbox in neutral at full engine throttle for about 15 seconds again.
5. Release the throttle pedal and decelerate the engine to idle.
6. Go back to point 2 and repeat until the APC200 display shows a temperature above 140°F [60°C]. When the temperature is above 140°F [60°C], the temperature indication on the display starts blinking. Now switch to automatic calibration by pressing the M-button several times – until the APC200 displays “tran”.

During this warm up procedure, it is possible for the converter out temperature of the transmission to exceed the maximum limit. This is a consequence of heating up the transmission using this quick procedure. When this occurs, the engine speed will be limited to half throttle when the APC200 has engine control or forcing neutral when the APC200 has no engine control. To solve this, simply leave the transmission in neutral for a minute and throttle the engine to around 1300 rpm. This will allow the heat in the converter to be evacuated. After one or two minutes, resume the heating up procedure if the transmission temperature has not reached 60°C yet.



CALIBRATION CONDITION MESSAGES AND CALIBRATION ERRORS

This chapter gives an overview of the most common calibration condition messages. Many calibration condition messages can be corrected, however, if any calibration error messages appear, contact the OEM of the machine.

Calibration Condition Messages

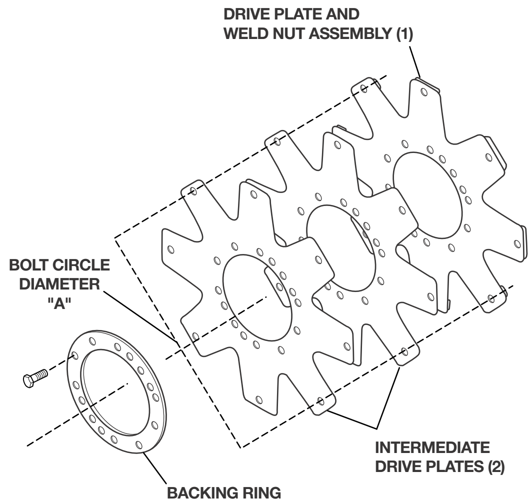
Go n	The APC200 expects the shift lever to be in NEUTRAL, but finds it in another position. (FORWARD or REVERSE)	Put the shift lever back in NEUTRAL.
PbOn	THE APC200 expects the parking brake to be ON while it is OFF.	Put the parking brake ON.
StoP	The APC200 has detected output speed.	Verify that the parking brake is ON and working properly. If this is already the case, keep the machine at standstill by using the brake. Once the machine has been stopped, the APC200 will ask the driver to shift to FORWARD before continuing the calibration.
rPM_	Engine RPM is to low according to the limit that is necessary for calibration.	When during the automatic transmission calibration the temperature becomes to low, the APC200 display indicates the actual transmission temperature. rPM_
rPM_	Engine RPM is to high according to the limit that is necessary for calibration.	
rPM_	After being to low or to high, the engine RPM is coming back into the correct boundaries for calibration.	
t°44	When during the automatic transmission calibration the temperature becomes to low, the APC200 display indicates the actual transmission temperature.	Use the M-button on the APC200 to go back to the 'HEAT' mode and the S-button to trigger this mode. Then warm-up the transmission again until the temperature is above 140°F [60°C]. Then go back to the automatic tuning mode by the M-button and trigger this one again to continue calibration.

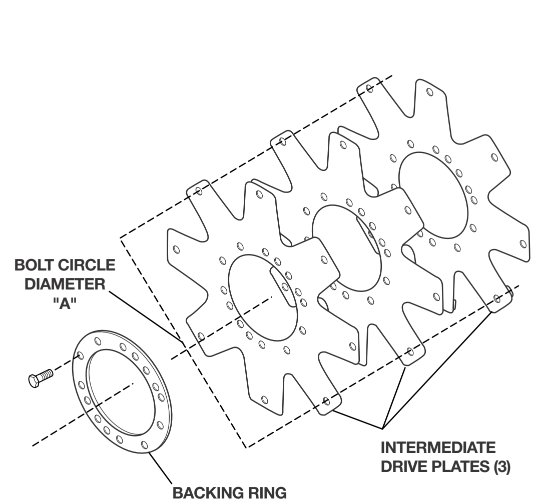
Calibration errors

Calibration errors have the form ‘E1.xx’ or ‘E2.xx’ (example: E1.25). Please contact the OEM of the machine if an error of this form appears on the display.

DRIVE PLATE INSTALLATION

Proper identification is determined by measuring the bolt circle diameter (see dimension “A” in the illustration below) and then ordering the appropriate drive plate kit from the table.





Each kit includes: 2 Intermediate Drive Plates 1 Drive Plate & Weld Nut Assembly 1 Backing Ring 10 Mounting Capscrews 10 Lockwashers Instruction Sheet	Each kit includes: 3 Intermediate Drive Plates 1 Backing Ring 10 Mounting Capscrews 10 Lockwashers Instruction Sheet
11.380” [288.9 mm] diameter	11.380” [288.9 mm] diameter
13.120” [332.2 mm] diameter	13.120” [332.2 mm] diameter
13.500” [342.9 mm] diameter	13.500” [342.9 mm] diameter

1. Position drive plate and weld nut assembly on torque converter assembly with weld nuts toward converter.
2. Align intermediate drive plates and backing ring with holes in torque converter assembly.
3. Two dimples 180° apart in backing ring must be facing outward toward engine flywheel (hollow side facing torque converter assembly).
4. Install capscrews and lockwashers. Tighten capscrews to 30-37 lbs. ft. (40-50 N•m).

NOTE:

Assembly of all plates must be completed within 15 minutes from when screws are installed. If a screw is removed for any reason it must be replaced. The adhesive left in the tapped holes must be removed with the proper tap and cleaned with solvent. Dry the hole thoroughly and use a new screw for reinstallation.

TRANSMISSION TO ENGINE INSTALLATION

1. Remove all burrs from flywheel mounting face and nose pilot bore. Clean drive plate surface with solvent. Dry thoroughly.
2. Check engine flywheel and housing for conformance to standards SAE #3 per SAE J-927 and J-1033 tolerance specifications for pilot bore size, pilot bore runout, and mounting face flatness. Measure and record engine crankshaft end play.
3. Install two 2.50” [63.5 mm] long transmission to flywheel housing guide studs in the engine flywheel housing as shown. Rotate the engine flywheel to align a drive plate mounting screw hole with the flywheel housing access hole.
4. *Install a 4.00” [101.6 mm] long drive plate locating stud .3750-24 fine thread in a drive plate nut. Align the locating stud in the drive plate with the flywheel drive plate mounting screw hole positioned in Step 3.
5. Rotate the transmission torque converter to align the locating stud in the drive plate with the flywheel drive plate mounting screw hole positioned in Step 3. Locate transmission on flywheel housing.
6. Align drive plate to flywheel and transmission to flywheel housing guide studs. Install transmission to flywheel housing screws. Tighten screws to specified torque. Remove transmission to engine guide studs. Install remaining screws and tighten to specified torque.
7. *Remove drive plate locating stud.
8. Install drive plate attaching screw and washer. Snug screw but do not tighten. Some engine flywheel housings have a hole located on the flywheel housing circumference in line with the drive plate screw access hole. A screwdriver or pry bar used to hold the drive plate against the flywheel will facilitate installation of the drive plate screws. Rotate the engine flywheel and install the remaining seven (7) flywheel to drive plate attaching screws. Snug screws but do not tighten. After all eight (8) screws are installed, tighten each capscrew to 26-29 lbs. ft. (35-39 N•m). This will require tightening each screw and rotating the engine flywheel until the full amount of eight (8) screws have been tightened to specified torque.
9. Measure engine crankshaft end play after transmission has been completely installed on engine flywheel. This value must be within 0.001” [0.025 mm] of the end play recorded in Step 2.

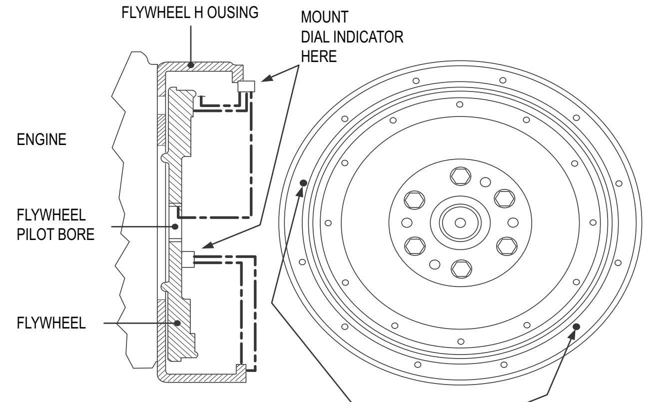
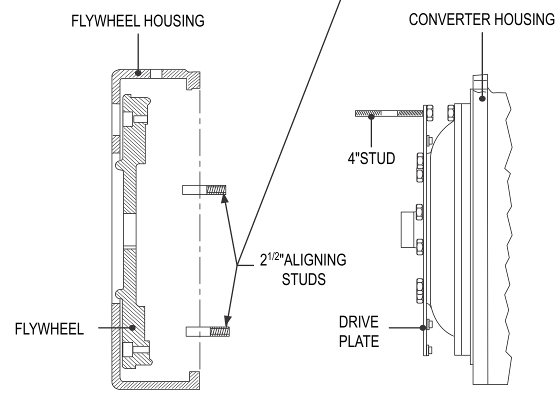


FIG. 1



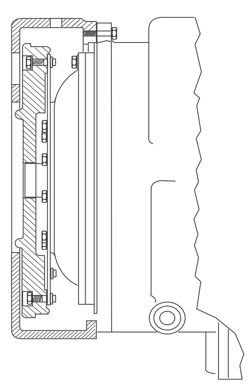


FIG. 3

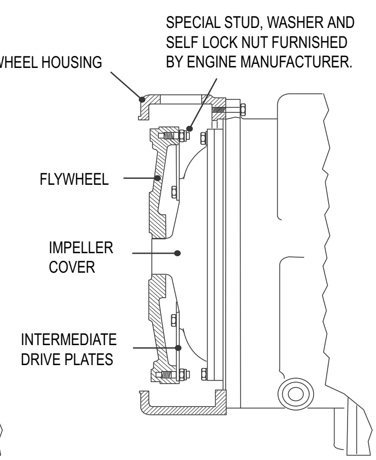


FIG.4

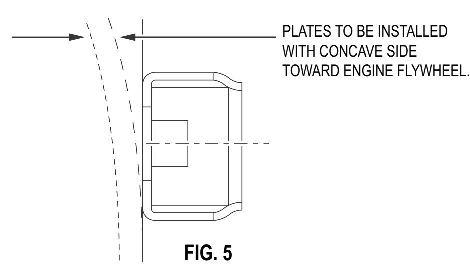


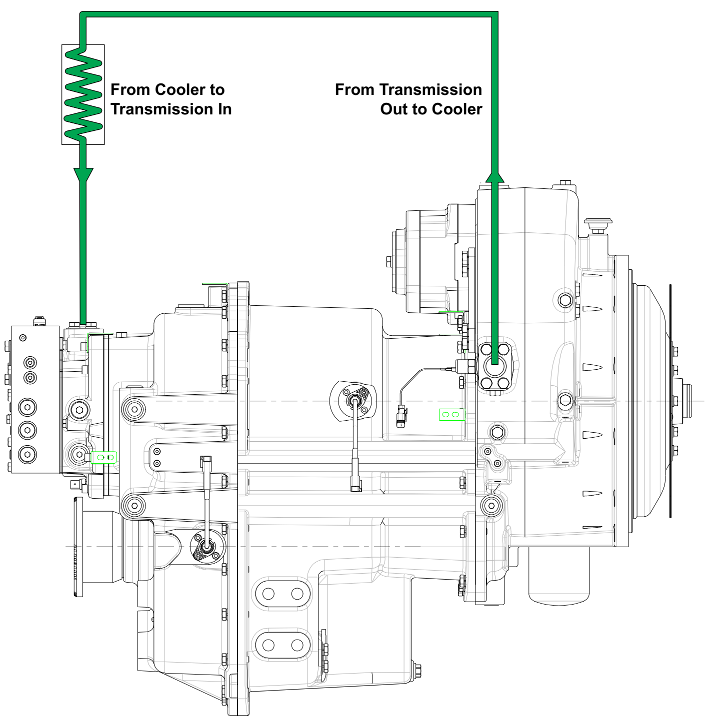
FIG. 5

* *Does not apply to units having 3 intermediate drive plates. See Figure 4.*

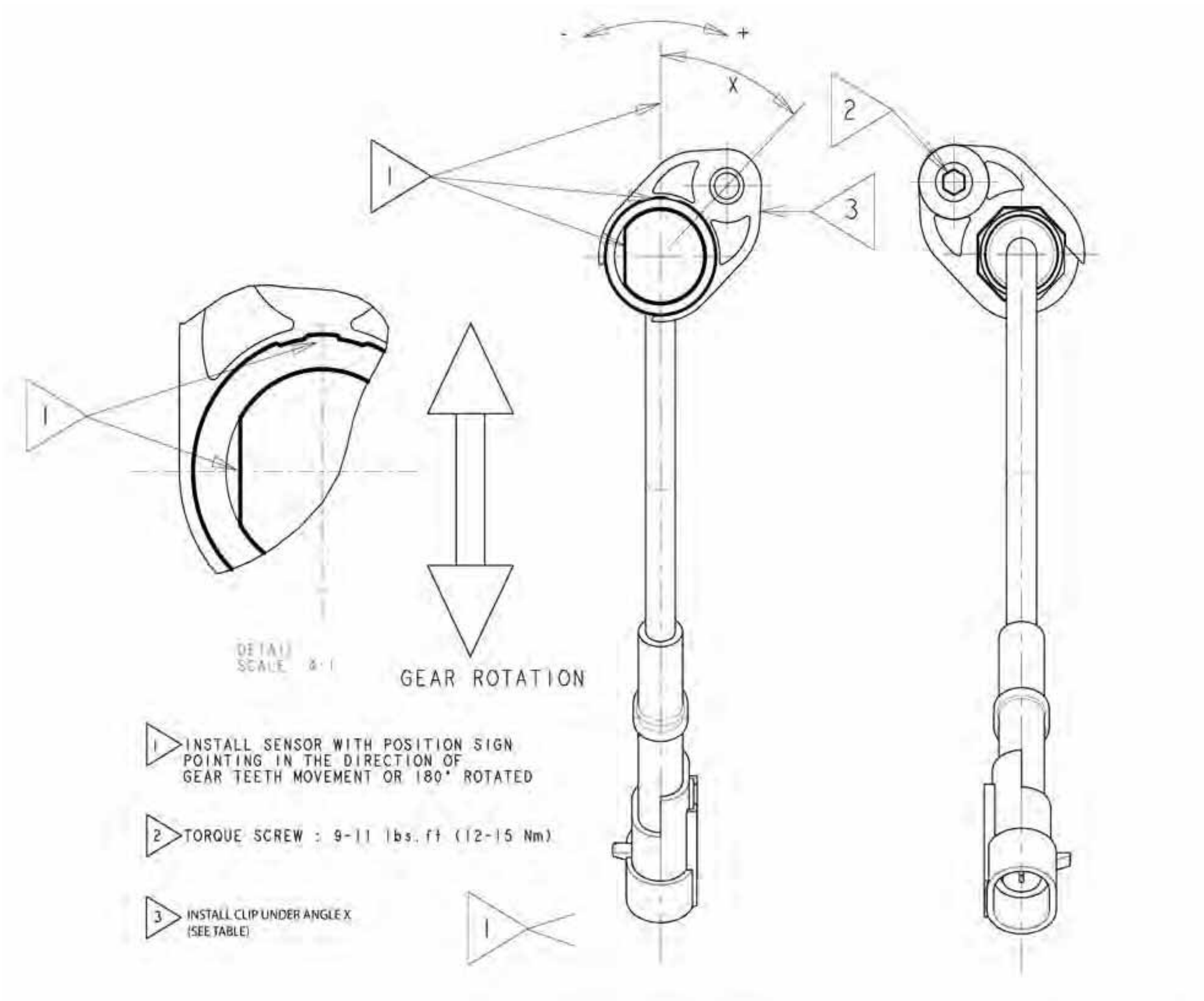
EXTERNAL PLUMBING INSTALLATION

Cooler Line Specifications

- Minimum 19 mm (.75 inch) internal diameter for lines and fittings.
- Suitable for operation from ambient to 120 °C (248 F) continuous operating temperature.
- Must withstand 30 bar (435 psi) continuous pressure and with 45 bar (652 psi) intermittent surges.
- Conform SAE J1019 and SAE J517,100RI.

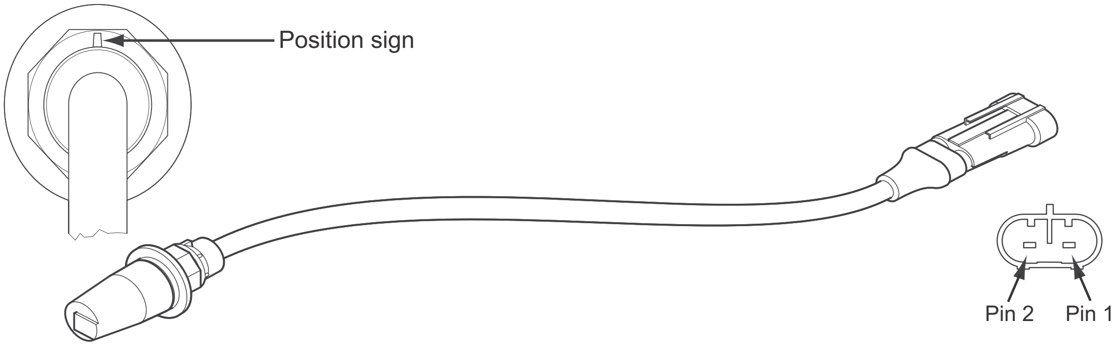


SPEED SENSOR INSTALLATION



TE13/17	4209831	DEUTZ 2 PINS	DRUM SPEED OUTPUT SPEED	-45 DEGREES -45 DEGREES
	4209832	DEUTZ 2 PINS	TURBINE SPEED	-45 DEGREES
	4209833	DEUTZ 3 PINS	ENGINE SPEED/ TEMPERATURE	-135 DEGREES

On the sensor body there is a small plastic triangular position sign. Make sure the position sign on the sensor points as shown below in the direction of the movement of the gear teeth (teeth rotation as shown), or 180° rotated.



The magneto resistive sensor generates a square wave current with a fixed amplitude changing between 7 - 14 mA.

The sensor has an integrated AMP super seal 2 pin connector. The two pins are numbered 1 and 2.

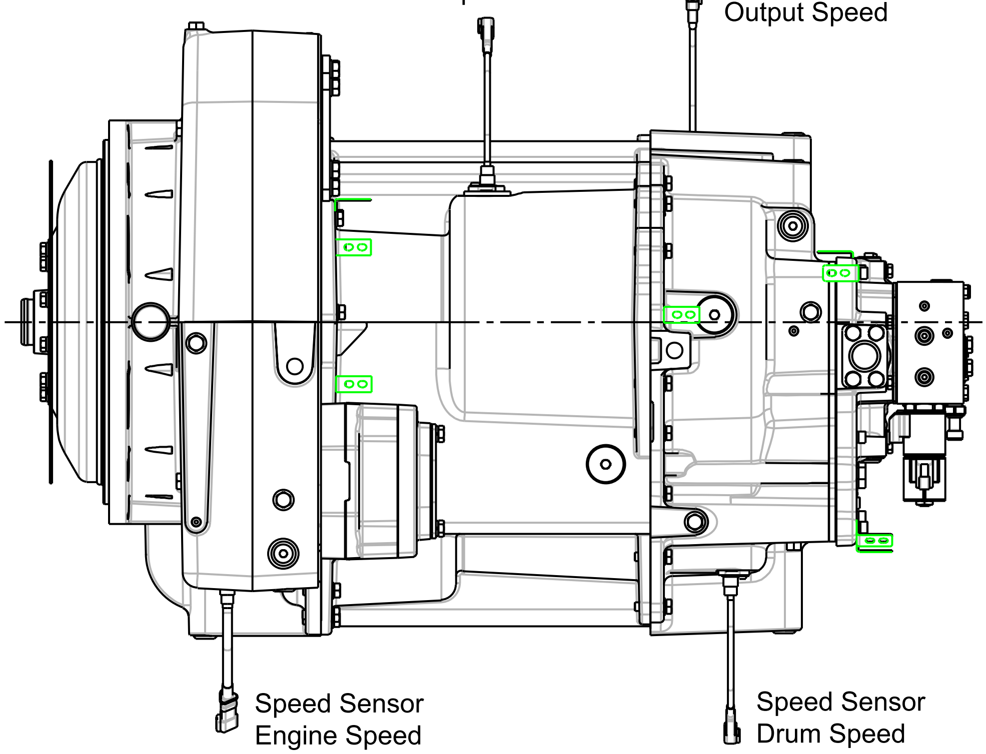
Following table shows the relation between wire color, pin number, and connection.

Pin	Function	Connection
1	Current Input	Hot Wire
2	Current Output	Ground Wire

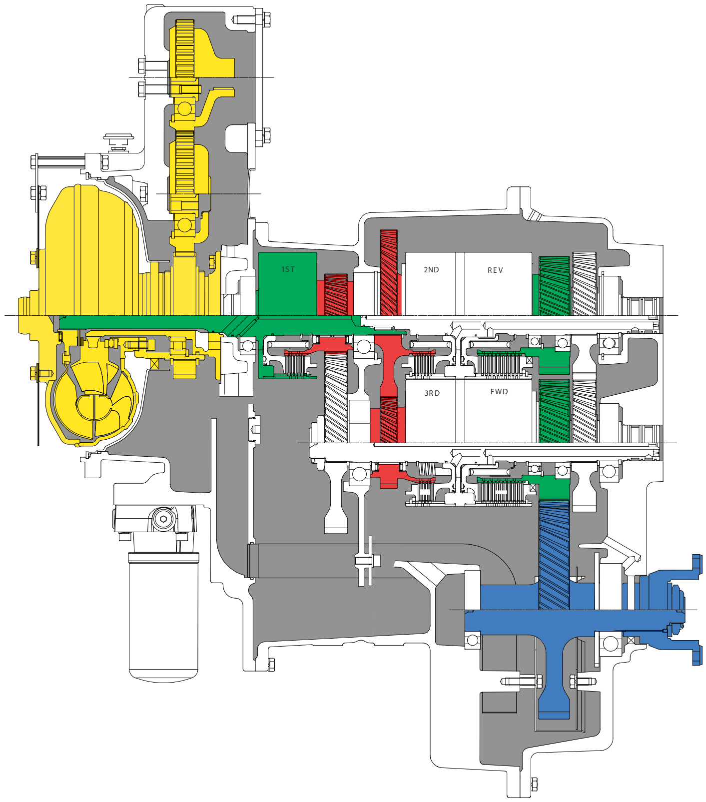
⚠CAUTION

The sensor wires have a polarity. Be sure to correctly observe sensor polarities, as wrong connections will deactivate the sensor!

Speed Sensor Locations



TRANSMISSION OPERATION



The transmission is composed of five main assemblies:

- Converter, pump drive section and pressure regulating valve
- Input shaft and directional clutches
- Range clutches
- Output section
- Control valve

Converter, Pump Drive Section, & Pressure Regulating Valve

Engine power is transmitted from the engine flywheel to the impeller through the impeller cover.

This element is the pump portion of the hydraulic torque converter and is the primary component which starts the oil flowing to the other components which results in torque multiplication. This element can be compared to a centrifugal pump, that picks up fluid at its centre and discharges it at the outer diameter.

The torque converter turbine is mounted opposite the impeller and is connected to the turbine shaft of the torque converter. This element receives fluid at its outer diameter and discharges it at its centre.

The reaction member of the torque converter is located between and at the centre of the inner diameters of the impeller and turbine elements. Its function is to take the fluid which is exhausting from the inner portion of the turbine and change its direction to allow correct entry for recirculation into the impeller element. This recirculation will make the converter to multiply torque.

The torque multiplication is function of the blading (impeller, turbine and reaction member) and the converter output speed (turbine speed). The converter will multiply engine torque to its designed maximum multiplication ratio when the turbine shaft is at zero RPM (stall).

Therefore we can say that as the turbine shaft is decreasing in speed, the torque multiplication is increasing.

The hydraulic pump is connected with the pump drive gear. This pump drive gear is driven by the impeller hub gear. Since the impeller hub gear is connected with the impeller cover, the pump speed is in direct relation with the engine speed.

Range Clutches

The turbine shaft driven from the turbine transmits power to the range clutches.

These clutches consist of a drum with internal splines and a bore to receive a hydraulic actuated piston. The piston is oil tight by the use of sealing rings. The steel discs with external splines, and friction discs with internal splines, are alternated until the required total is achieved.

A back-up plate is then inserted and secured with a retainer ring. A hub with outer diameter splines is inserted into the splines of discs with teeth on the inner diameter. The discs and hub are free to increase in speed or rotate in the opposite direction as long as no pressure is present in that specific clutch.

To engage a clutch the current of the electronic controlled modulation solenoid should go from 0 to 1000 mA in order to change the pressure to the clutch from 0 to maximum pressure. The oil under pressure will go through tubes and passages to the selected clutch shafts.

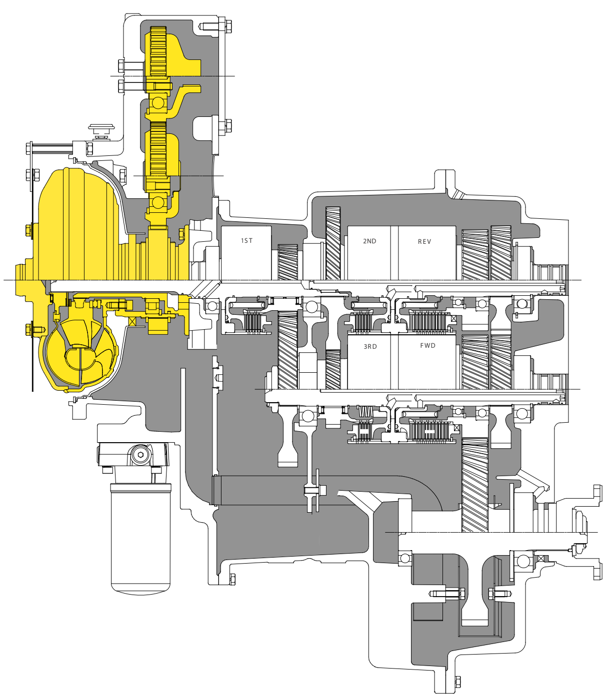
This means that clutch pressure is built up gradually. This will enable the unit to make forward, reverse shifts while the vehicle is still moving and will allow smooth engagement of drive.

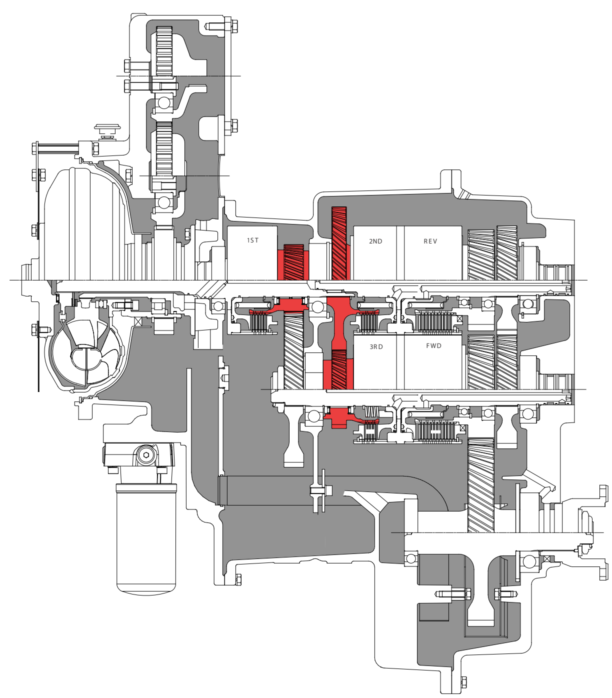
Oil sealing rings are located on the clutch shafts. These rings direct the oil through a drilled passage in the shaft to the desired clutch.

Pressure of the oil forces the piston and discs against the back-up plate. The discs with splines on the outer diameter clamping against discs with teeth on the inner diameter enables the drum and hub to be locked together and allows them to drive as one unit.

When the clutch is released, a return spring will push the piston back and oil will drain back via the shift spool bleed holes in the clutch piston into the transmission sump.

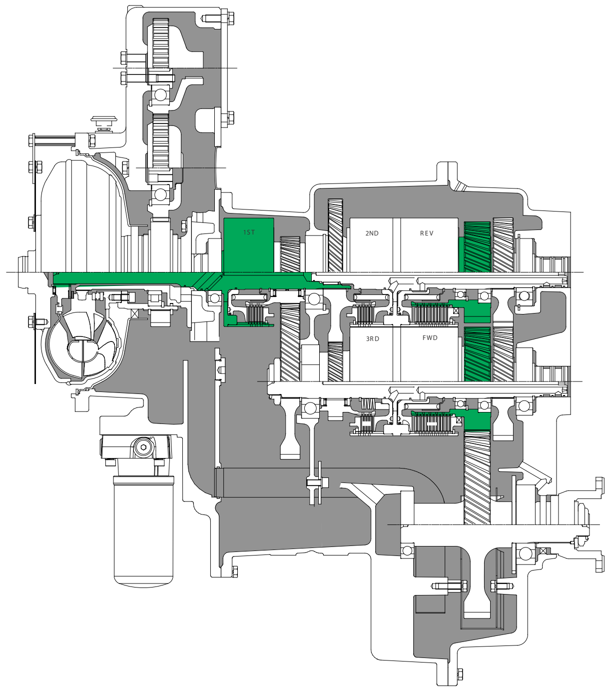
These bleed holes will only allow quick escape of oil when the pressure to the piston is released.





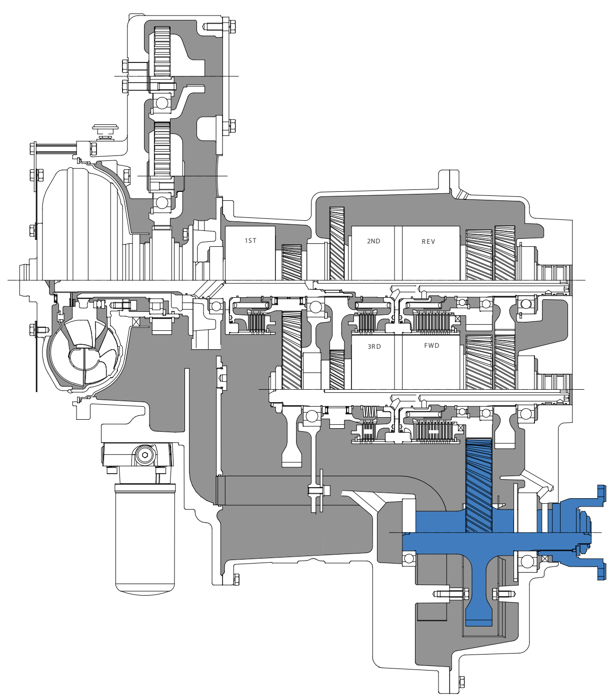
Input Shaft and Directional Clutches

Once a range clutch is engaged power is transmitted to the directional clutches. Operation of the directional clutches is similar to the range clutches.



Output Section

With a directional clutch engaged, power is finally transmitted to the output shaft. Output rotation is same as the input rotation when the forward clutch is engaged.



Transmission Controls

The transmission is controlled by the control valve (refer to hydraulic diagrams for additional information). The control valve assembly is mounted directly on the side of the rear cover. The function of the control valve assembly is to direct oil under pressure to the desired directional and speed clutches.

Operation of the Valve

Regulated pressure 377-450 PSI [26-31 bar] is directed to the proportional valve and selector valves to activate the required clutches.

When activated the proportional valve will give an output pressure curve from 0-450 PSI [0-31 bar] proportional to a current from 0 mA to 1000 mA. Dampers are used to dampen any hydraulic vibration.

Directional Selection

When a direction (forward or reverse) is selected, the required selector valve is activated for forward or reverse and the proportional valve will provide a pressure rise from 0 to 31 bar feeding the directional clutch with modulated pressure.

Range Selection

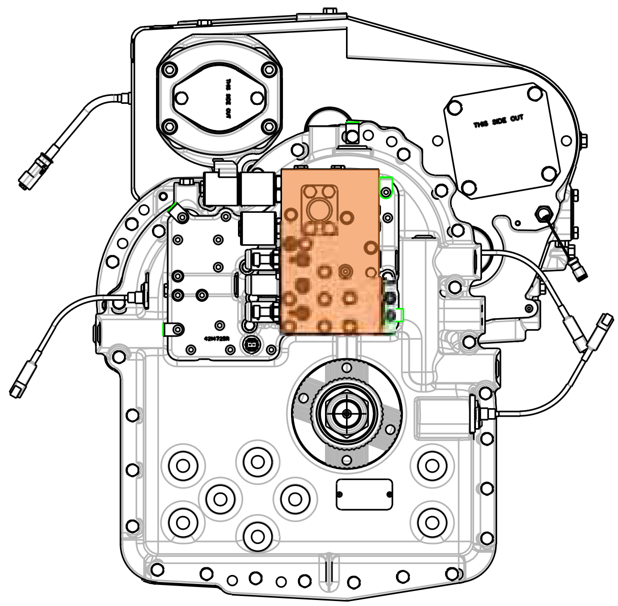
When 1st clutch is selected, the 1st/3rd selector valve is activated and the 1st/3rd proportional valve will provide a pressure rise from 0 to 31 bar feeding the 1st clutch with modulated pressure.

When 2nd clutch is selected, the 1st/3rd proportional valve will decrease pressure from 31 to 0 bar, thus releasing the 1st clutch in a controlled manner. At the same time, the 2nd proportional valve is activated and will provide a pressure curve from 0 to 31 bar, which will provide clutch overlap. When the shift is finalized, the 1st/3rd selector valve is deactivated.

When 3rd clutch is selected, the 1st/3rd selector valve is not activated. The 2nd proportional valve will decrease pressure from 31 to 0 bar, thus releasing the 2nd clutch in a controlled manner. At the same time the 1st/3rd proportional valve is activated and will provide a pressure curve from 0 to 31 bar, which will provide clutch overlap.

Pressure Sensor

The control valve also has a pressure sensor installed to monitor overlap on range clutches.

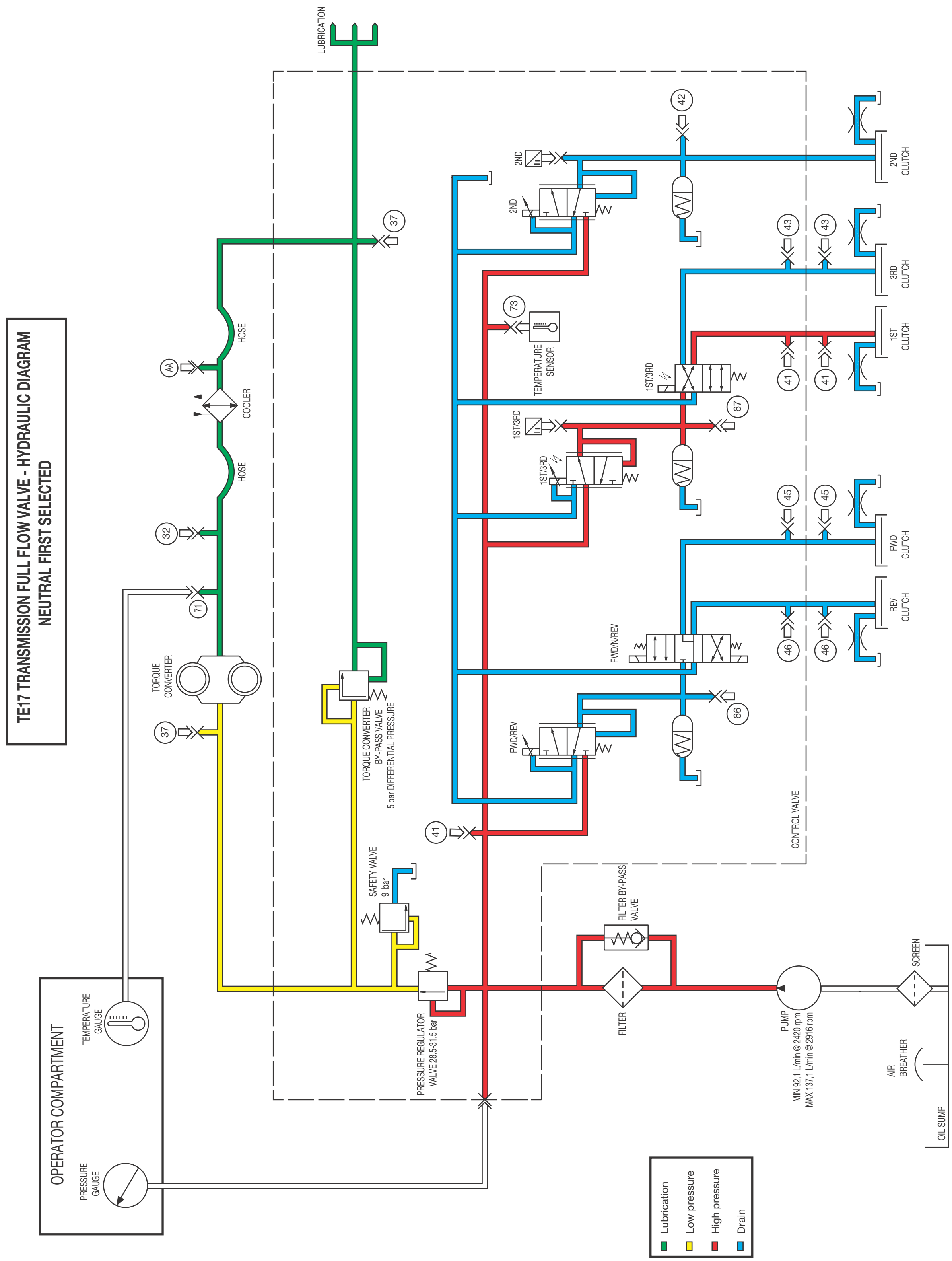


Electric Solenoid Controls

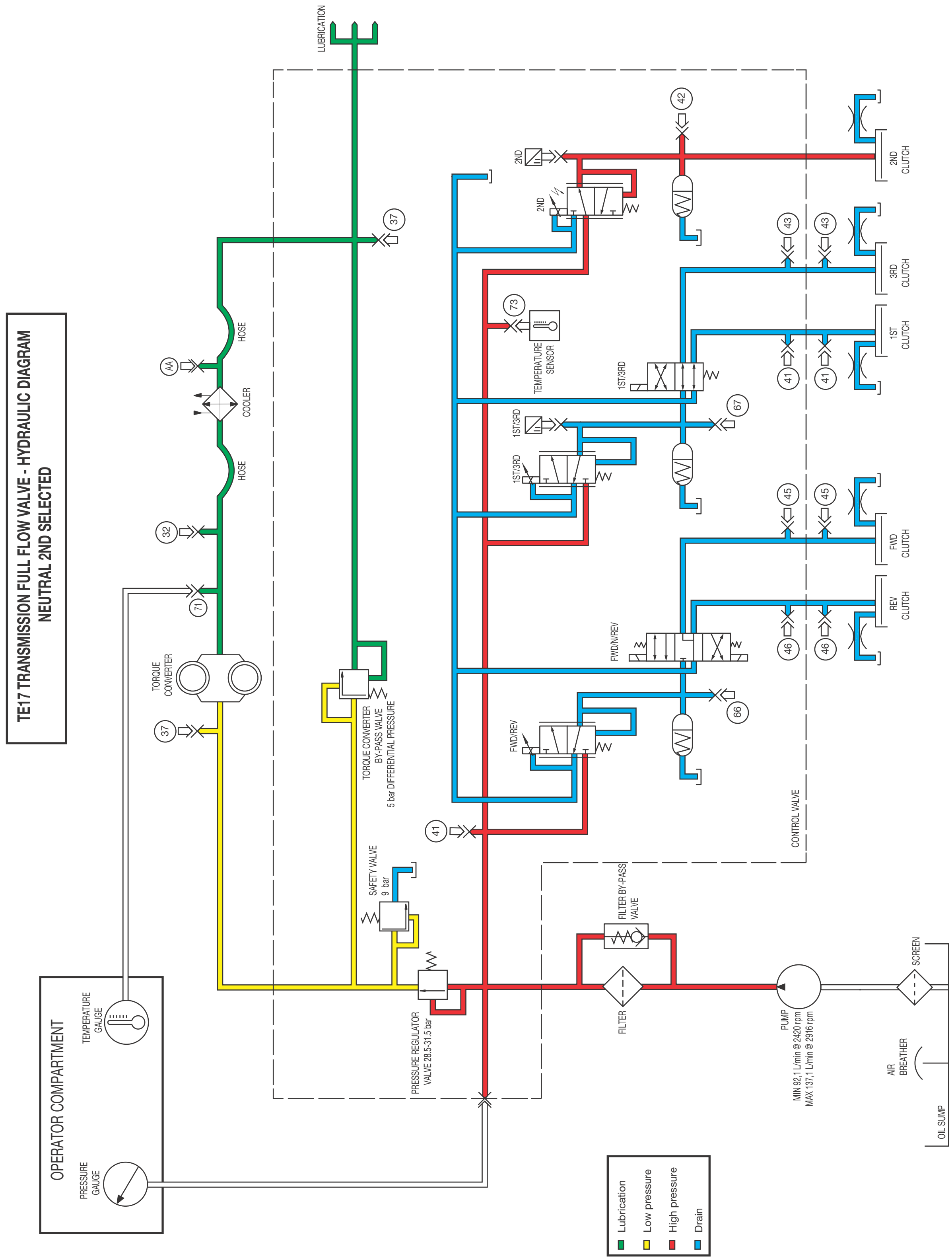
Transmission Gear	Activated Selector Valve	Activated Proportional Valve	Activated Clutches
Forward 3	FWD	FWD/REV, 1st/3rd	Forward, 3rd
Forward 2	FWD, 2nd	FWD/REV, 2nd	Forward, 2nd
Forward 1	FWD, 1st/3rd	FWD/REV, 1st/3rd	Forward, 1st
Neutral 3		1st/3rd	3rd
Neutral 2	2nd	2nd	2nd
Neutral 1	1st/3rd	1st/3rd	1st
Reverse 3	REV	FWD/REV, 1st/3rd	Reverse, 3rd
Reverse 2	REV, 2nd	FWD/REV, 2nd	Reverse, 2nd
Reverse 1	REV, 1st/3rd	FWD/REV, 1st/3rd	Reverse, 1st

Power Flows, Activated Solenoids, & Hydraulic Circuits

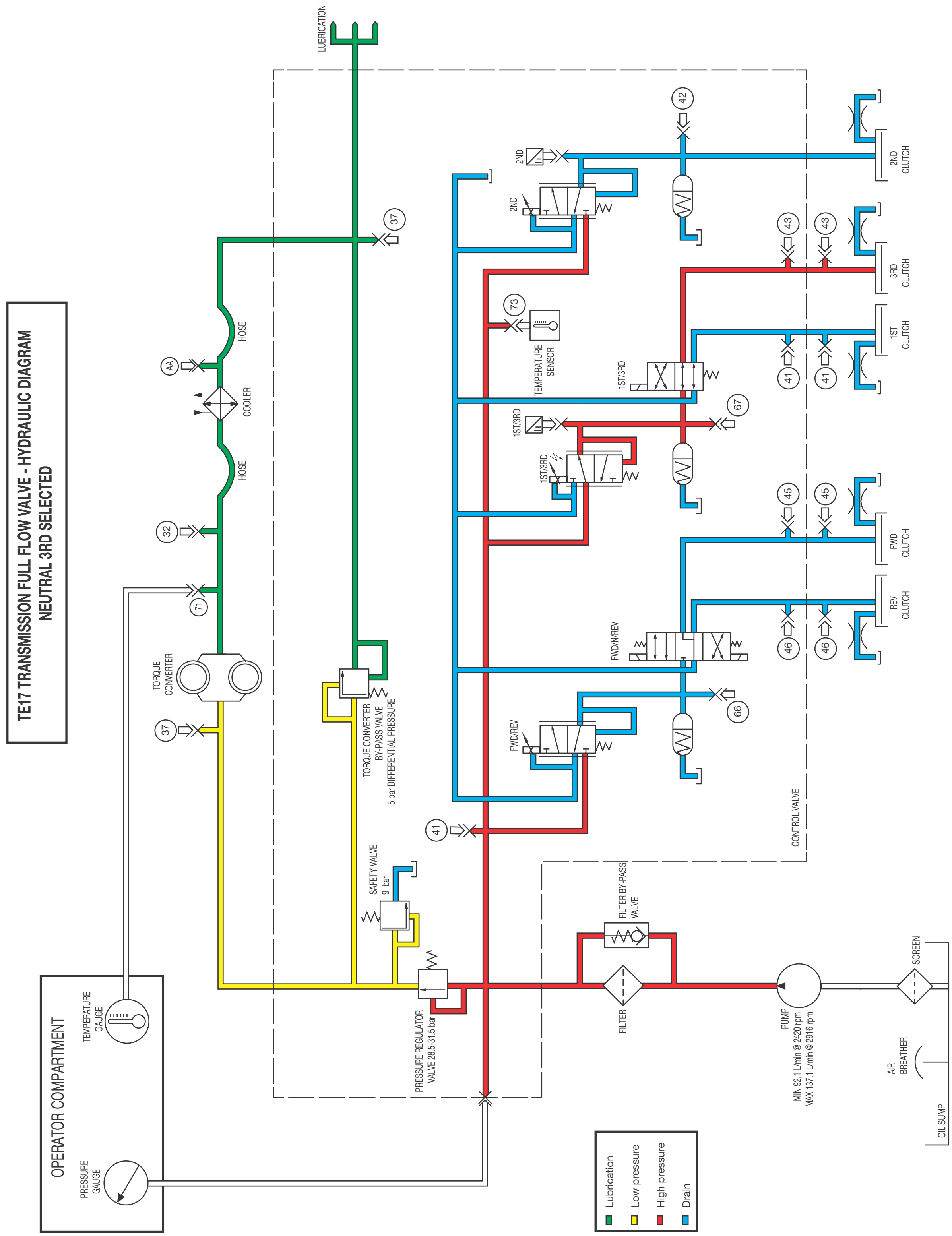
Neutral 1st



Neutral 2nd

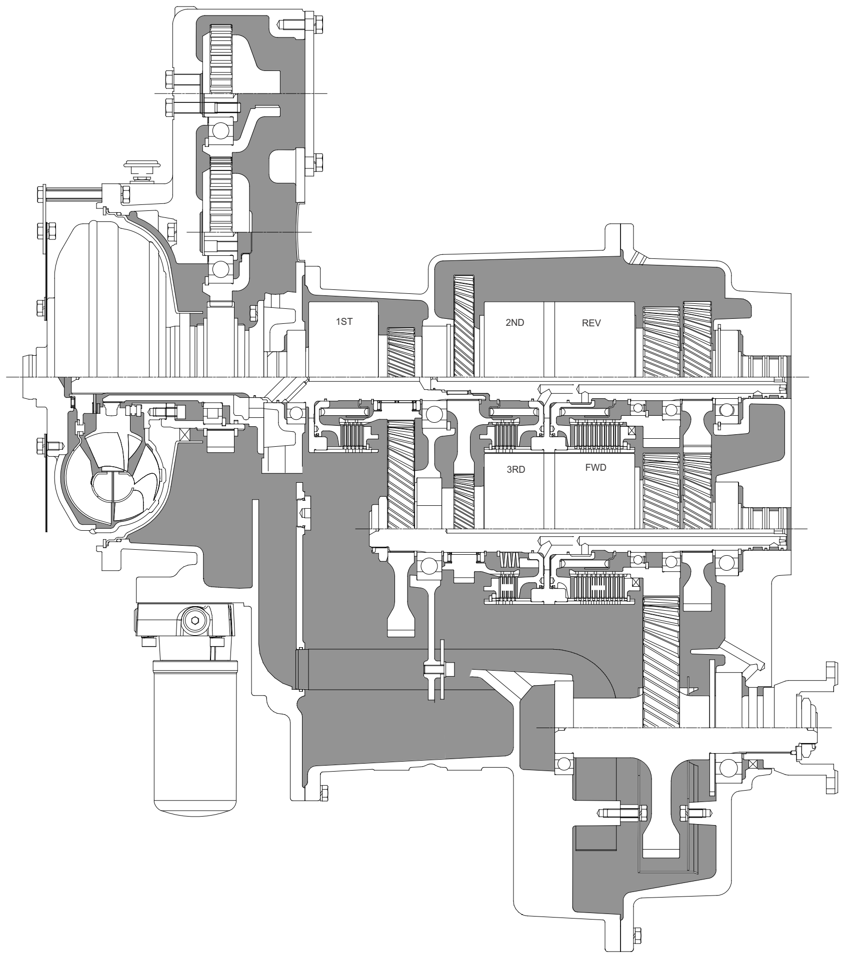

TE17 TRANSMISSION FULL FLOW VALVE - HYDRAULIC DIAGRAM
NEUTRAL 2ND SELECTED
LUBRICATION
HOSE
COOLER
HOSE
AA
32
71
37
TORQUE CONVERTER
TORQUE CONVERTER BY-PASS VALVE 5 bar DIFFERENTIAL PRESSURE
SAFETY VALVE 9 bar
PRESSURE REGULATOR VALVE 28.5-31.5 bar
41
73
TEMPERATURE SENSOR
2ND
2ND
1ST/3RD
1ST/3RD
1ST/3RD
FWD/N/REV
FWD/REV
42
43
43
41
41
67
45
45
46
46
66
2ND CLUTCH
3RD CLUTCH
1ST CLUTCH
FWD CLUTCH
REV CLUTCH
CONTROL VALVE
FILTER BY-PASS VALVE
FILTER
PUMP
MIN 92,1 L/min @ 2420 rpm
MAX 137,1 L/min @ 2916 rpm
SCREEN
AIR BREATHER
OIL SUMP
OPERATOR COMPARTMENT
TEMPERATURE GAUGE
PRESSURE GAUGE
Lubrication
Low pressure
High pressure
Drain

Neutral 3rd

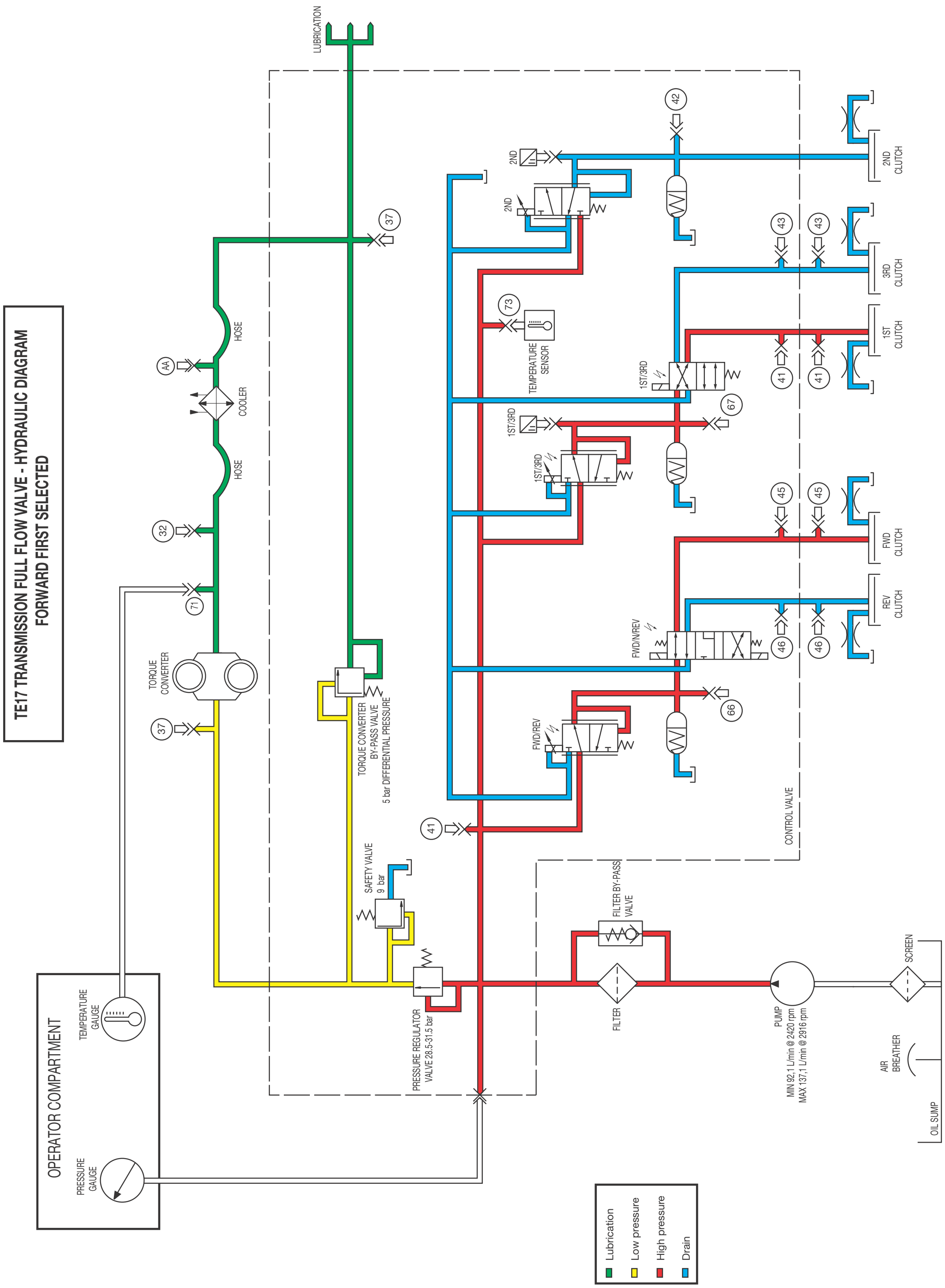


TE17 TRANSMISSION FULL FLOW VALVE - HYDRAULIC DIAGRAM
NEUTRAL 3RD SELECTED
LUBRICATION
37
HOSE
AA
COOLER
HOSE
32
71
TORQUE CONVERTER
37
TORQUE CONVERTER BY-PASS VALVE
5 bar DIFFERENTIAL PRESSURE
SAFETY VALVE
9 bar
PRESSURE REGULATOR VALVE 28.5-31.5 bar
41
FILTER
FILTER BY-PASS VALVE
PUMP
MIN 92,1 L/min @ 2420 rpm
MAX 137,1 L/min @ 2916 rpm
SCREEN
AIR BREATHER
OIL SUMP
CONTROL VALVE
2ND
2ND
73
TEMPERATURE SENSOR
1ST/3RD
1ST/3RD
1ST/3RD
67
FWD/N/REV
FWD/REV
66
42
43
43
41
41
45
45
46
46
2ND CLUTCH
3RD CLUTCH
1ST CLUTCH
FWD CLUTCH
REV CLUTCH
OPERATOR COMPARTMENT
TEMPERATURE GAUGE
PRESSURE GAUGE
Lubrication
Low pressure
High pressure
Drain

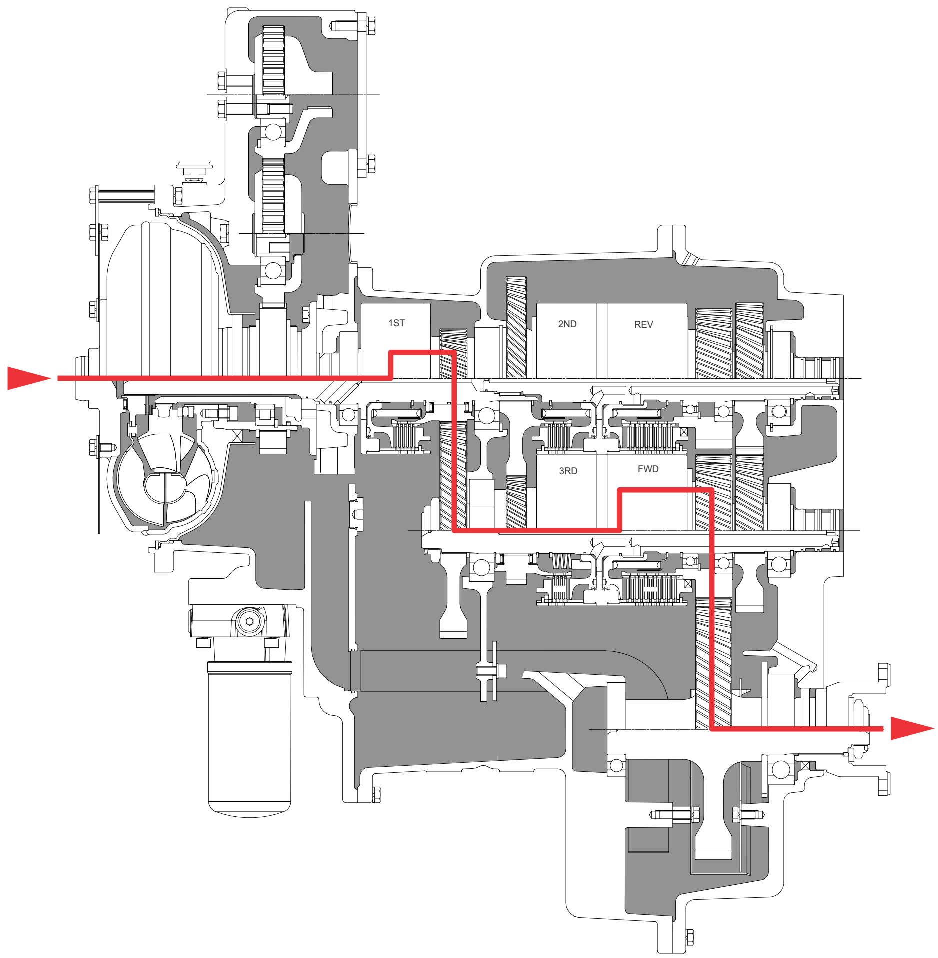
Neutral (Continued)



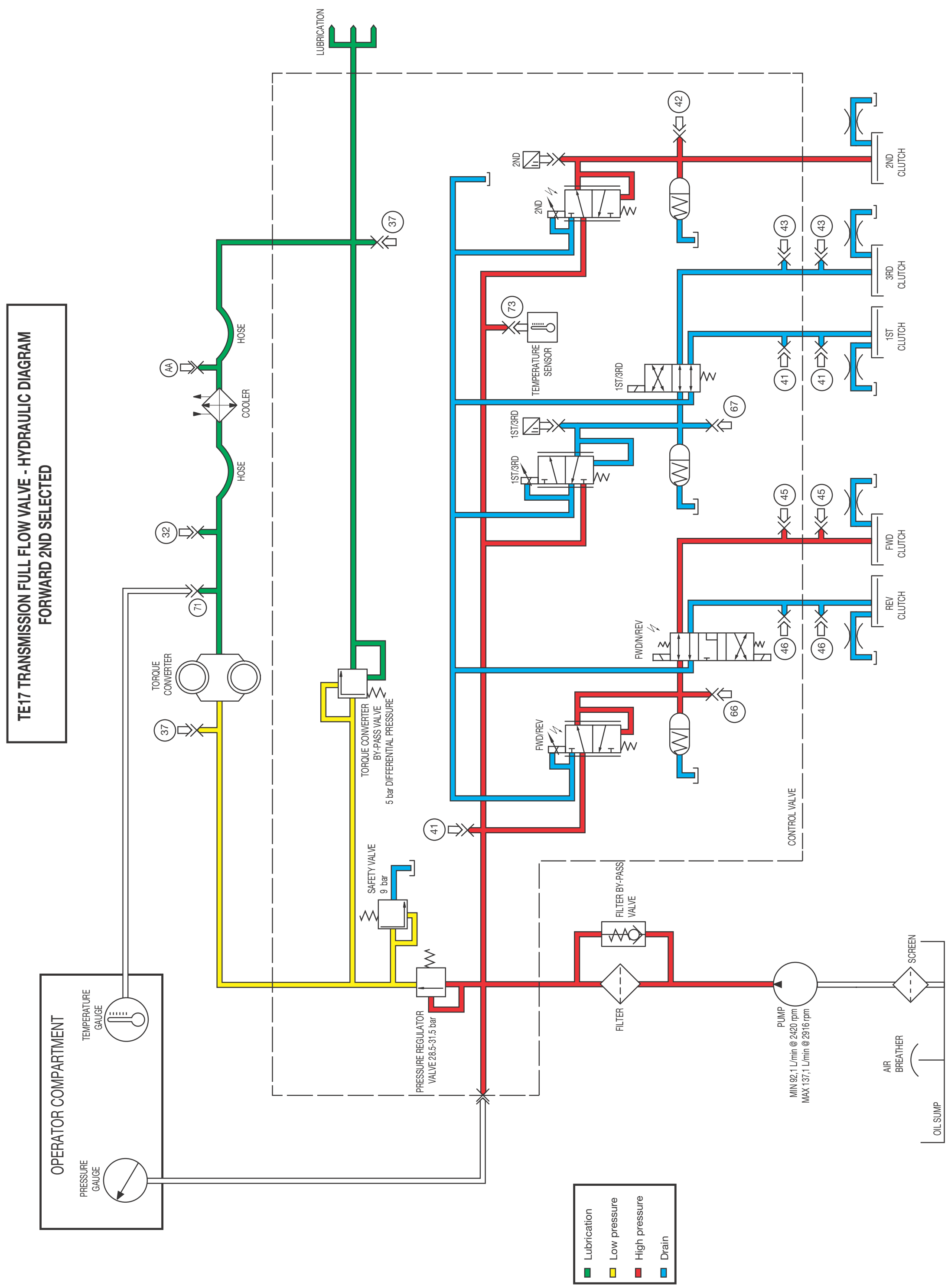
Forward 1st Speed



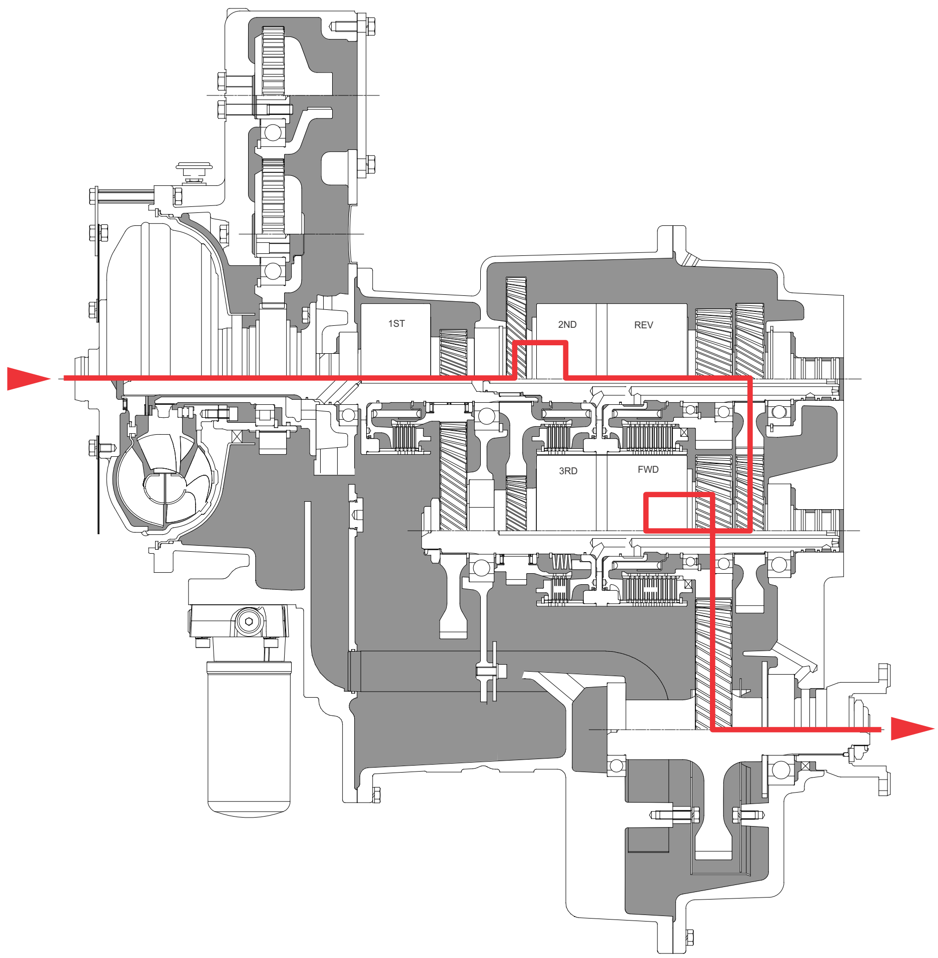
Forward 1st Speed (Continued)



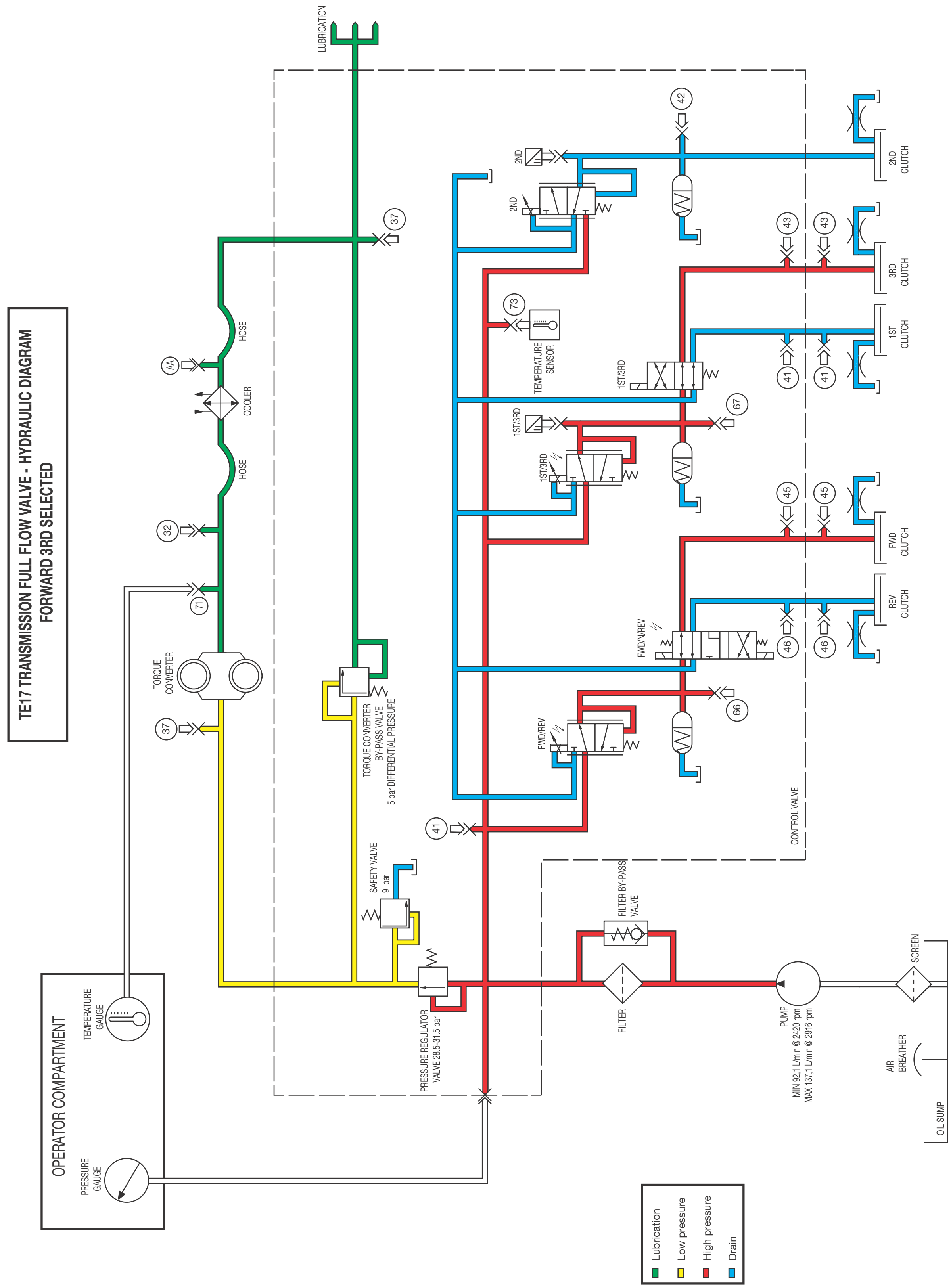
Forward 2nd Speed



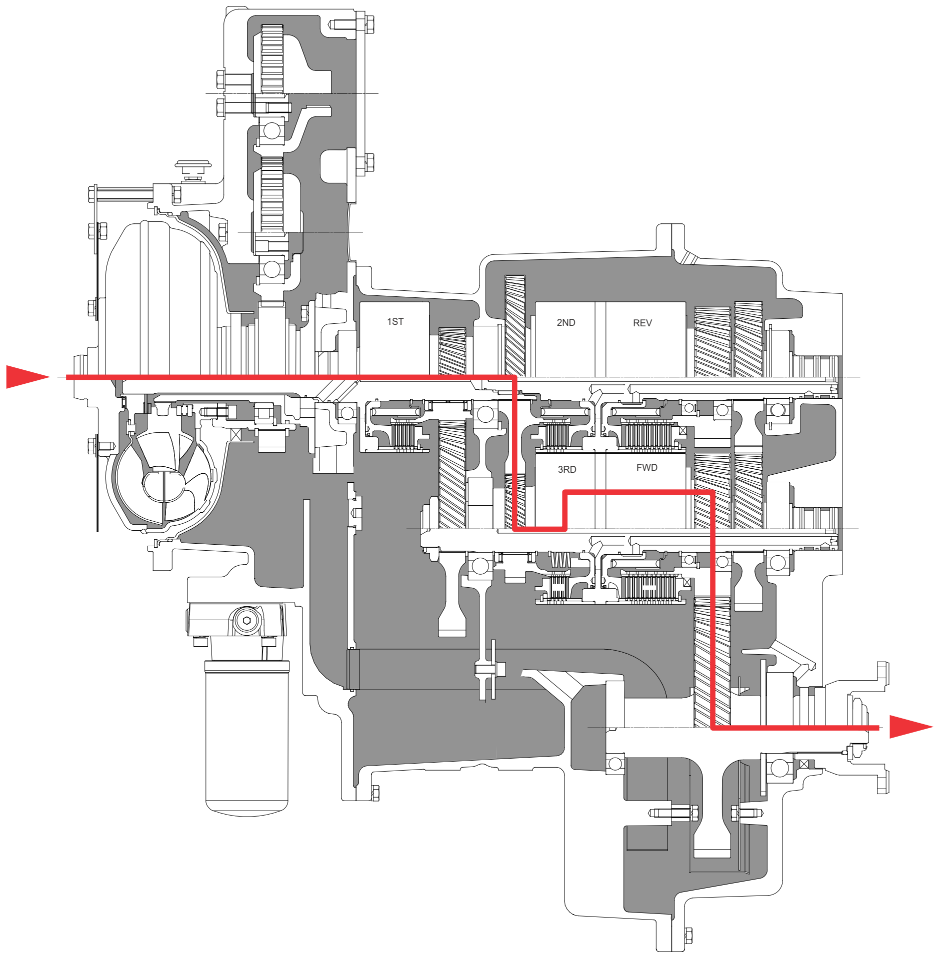
Forward 2nd Speed (Continued)



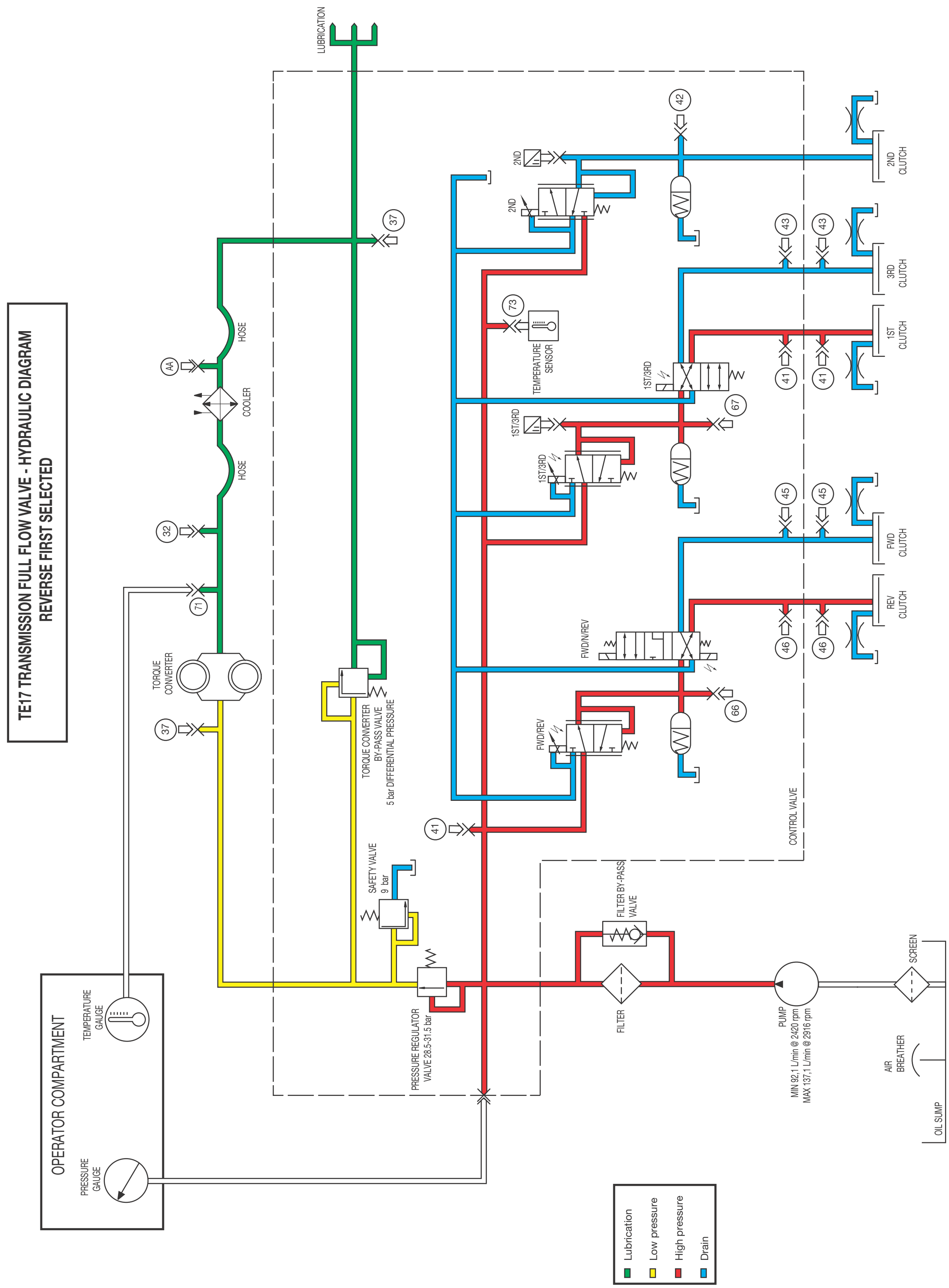
Forward 3rd Speed



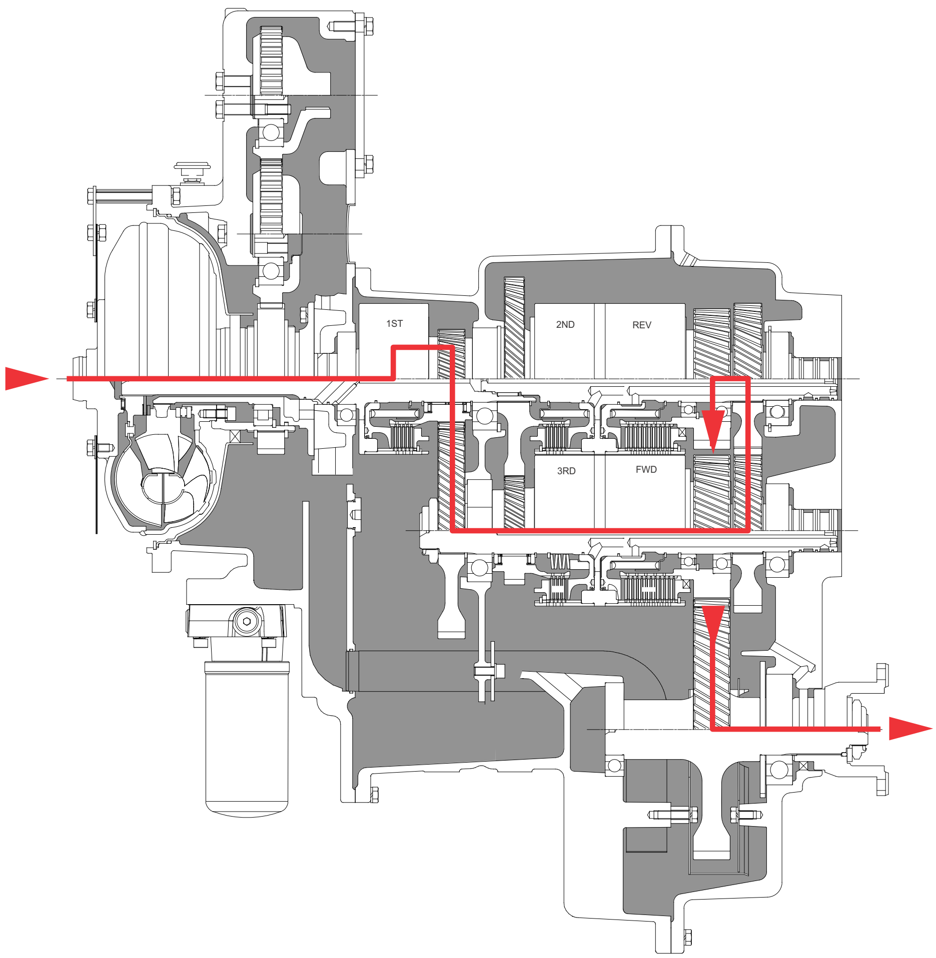
Forward 3rd Speed (Continued)



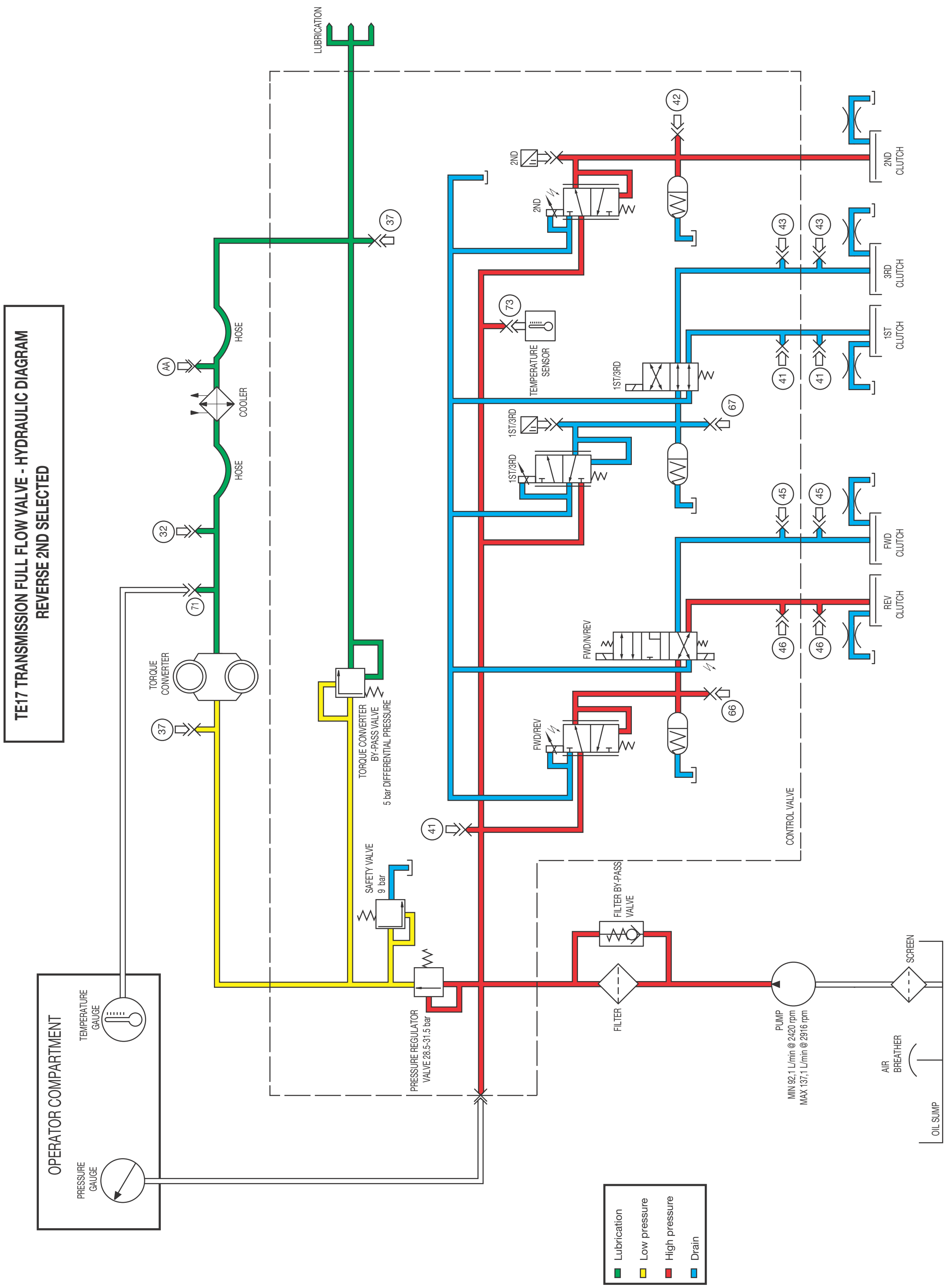
Reverse 1st Speed



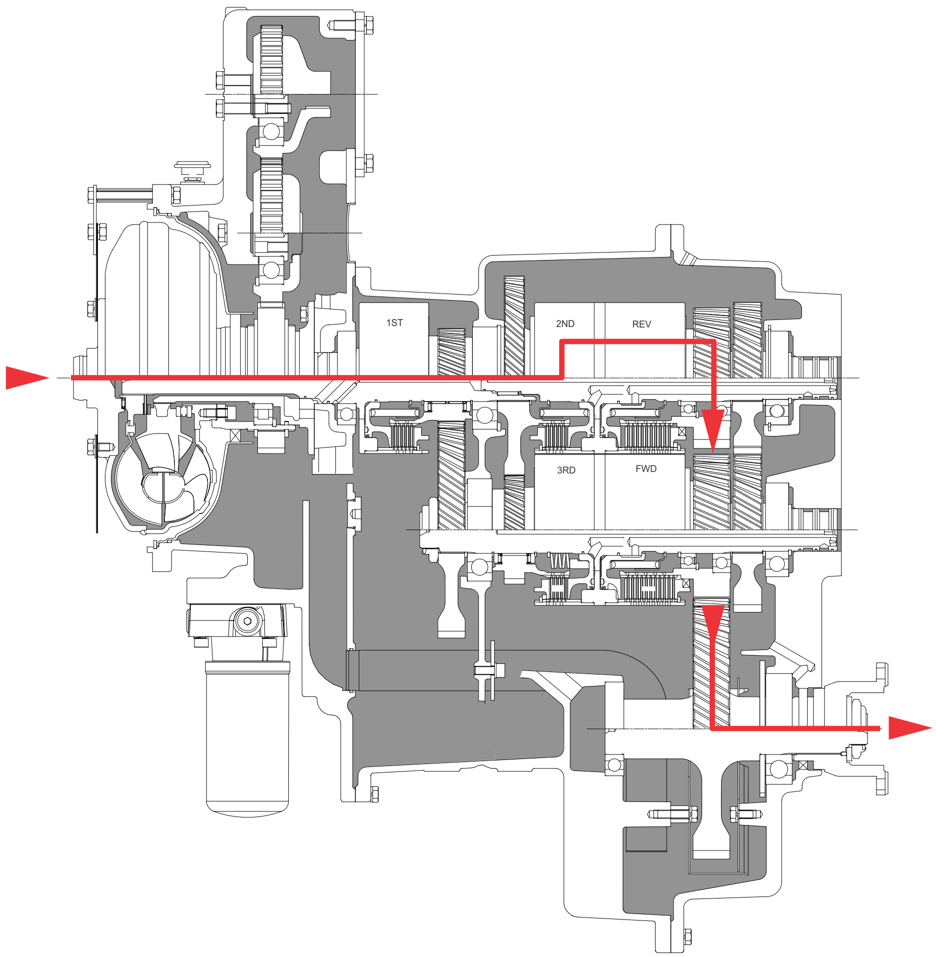
Reverse 1st Speed (Continued)



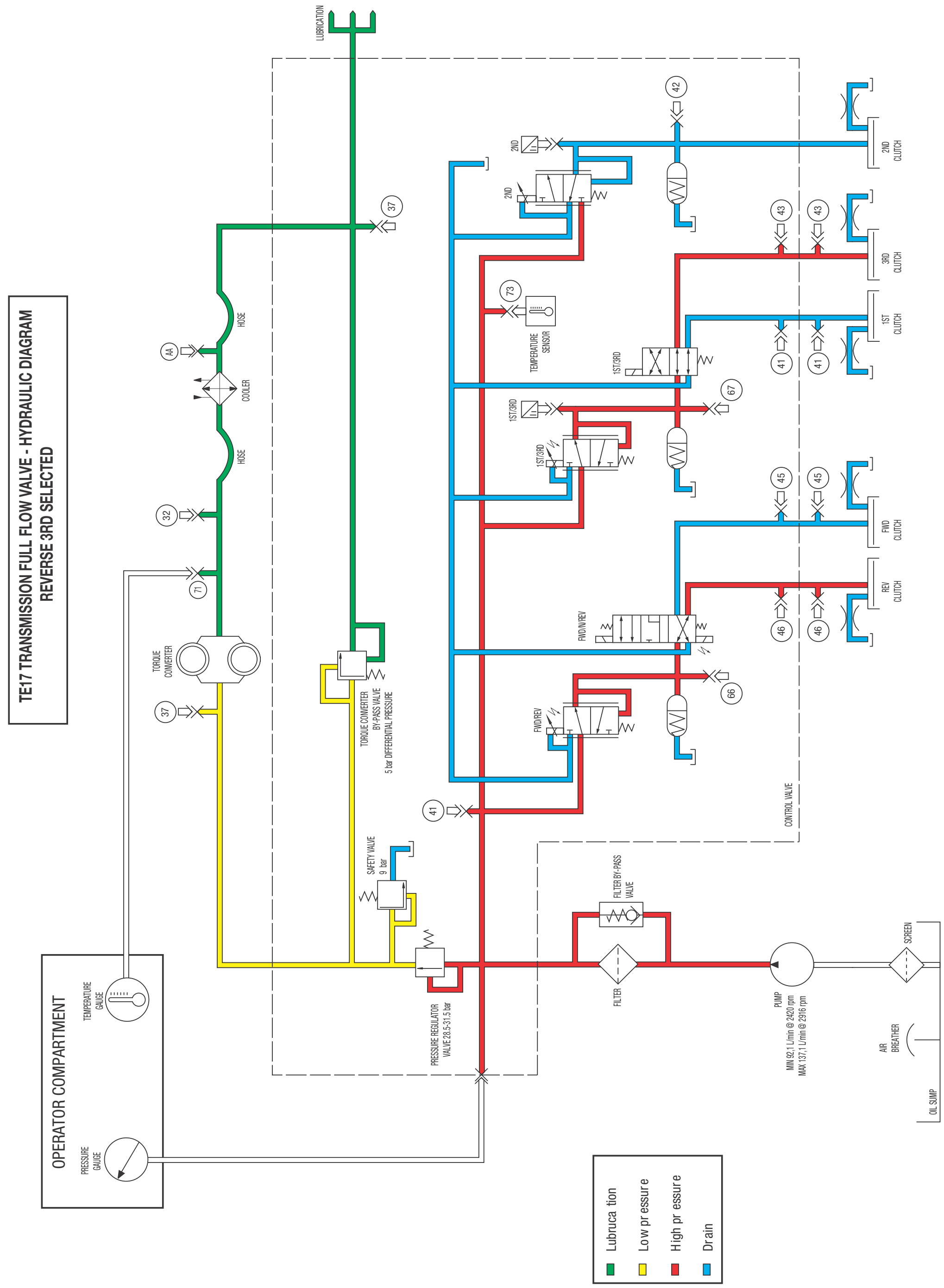
Reverse 2nd Speed



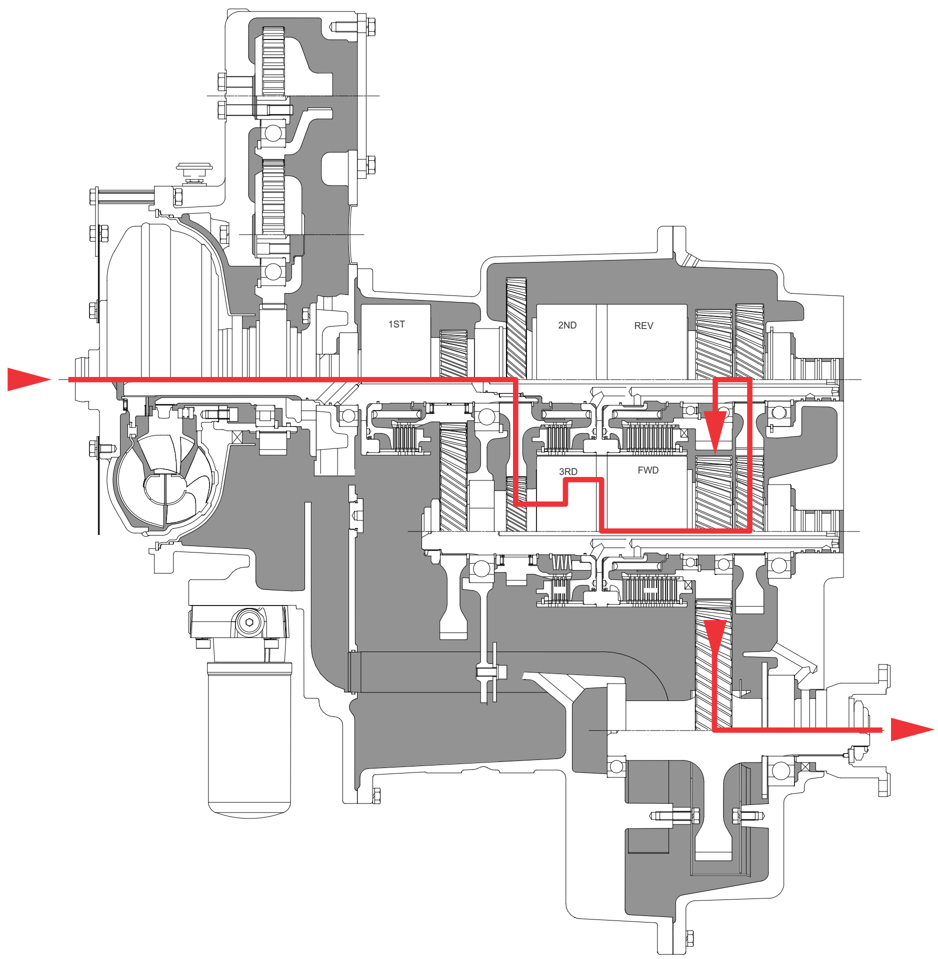
Reverse 2nd Speed (Continued)



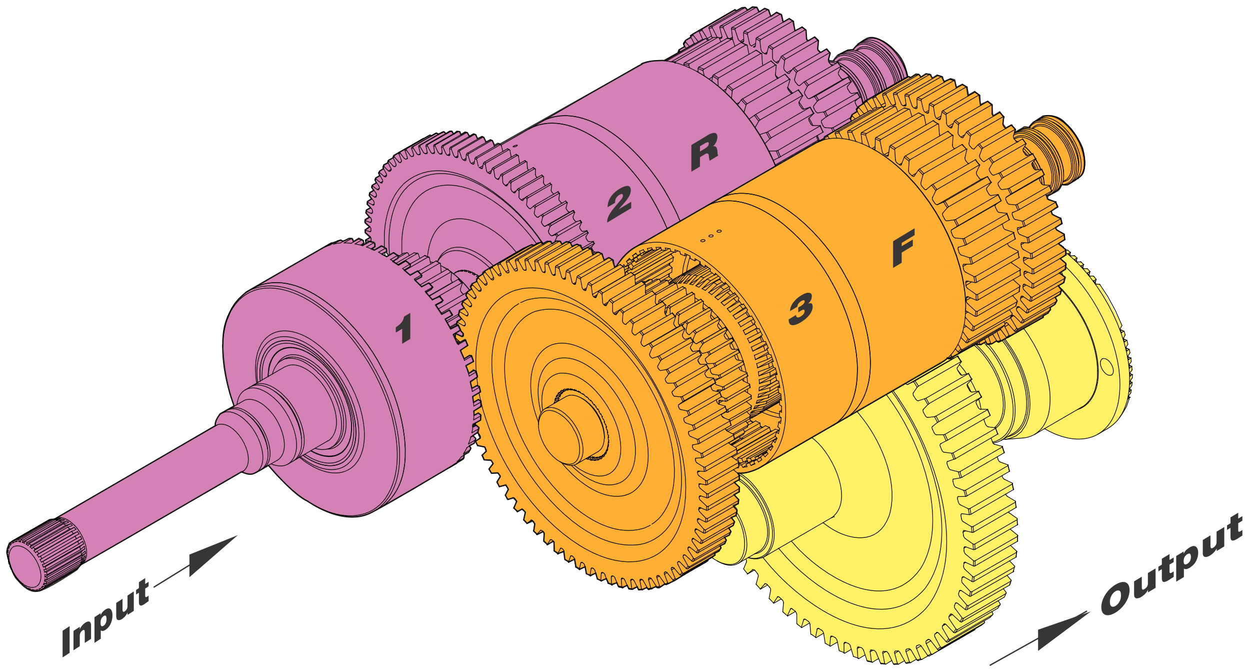
Reverse 3rd Speed



Reverse 3rd Speed (Continued)



Gear & Clutch Layout



TROUBLESHOOTING

The following information is presented as an aid to isolate and determine the specific problem areas in a transmission that is not functioning correctly.

When troubleshooting a “transmission” problem, it should be kept in mind that the transmission is only the central unit of a group of related powertrain components. Proper operation of the transmission depends on the condition and correct functioning of the other components of the group. Therefore, to properly diagnose a suspected problem in the transmission, it is necessary to consider the transmission fluid, charging pump, torque converter, transmission assembly, oil cooler, filter, connecting lines, and controls, including the engine, as a complete system.

By analyzing the principles of operation together with the information in this section, it should be possible to identify and correct any malfunction which may occur in the system.

Transmission Problems

TE13 & TE17 (power shift with torque converter transmission) troubles fall into four general categories:

1. Mechanical problems.
2. Hydraulic problems.
3. Electrical problems.
4. Controller problems

In addition to the mechanical and electrical components, all of which must be in the proper condition and functioning correctly, the correct functioning of the hydraulic circuit is most important. Transmission fluid is the “life blood” of the transmission. It must be supplied in an adequate quantity and delivered to the system at the correct pressures to ensure converter operation, to engage and hold the clutches from slipping, and to cool and lubricate the working components.

Troubleshooting Procedures

Input Shaft and Directional Clutch Problems

Stall Test

⚠CAUTION
Do not operate the converter at stall condition longer than 30 seconds at one time, shift to neutral for 15 seconds and repeat the procedure until desired temperature is reached. Excessive temperature 250°F / 120°C maximum will cause damage to transmission clutches, fluid, converter, and seals.

A stall test to identifies transmission, converter, or engine problems.

Use following procedure:

1. Put the vehicle against a solid barrier, such as a wall, and/or apply the parking brake and block the wheels.
2. Put the directional control lever in FORWARD (or REVERSE, as applicable).
3. Select the highest speed. With the engine running, slowly increase engine speed to approximately one-half throttle and hold until transmission (converter outlet) oil temperature reaches the operating range [158°F / 70°C}.
4. Once the oil temperature reaches 158°F / 70°C check maximum stall speed at full throttle in all gears. The figure obtained should be within 50 RPM, as mentioned in the vehicle handbook, and should be equal in all gears. Between gears allow the converter outlet temperature to cool down to 158°F / 70°C by selecting neutral.
   If maximum stall speed measured is below specifications, it could indicate an engine or converter problem.
   If maximum stall speed measure is above specifications, it could indicate slipping clutches.

Transmission Pressure Checks

Transmission problems can be isolated by the use of pressure tests. When the stall test indicates slipping clutches, then measure clutch pack pressure to determine if the slippage is due to low pressure or clutch plate friction material failure.

In addition, converter charging pressure and transmission lubrication pressure can also be measured.

Mechanical and Electrical Checks

Prior to checking any part of the system for hydraulic function (pressure testing), the following mechanical and electrical checks should be made:

- Check the parking brake and inching pedal for correct adjustment.
- Be sure all lever linkage is properly connected and adjusted in each segment and at all connecting points.
- The controls are actuated electrically. Check the wiring and electrical components.
- Be sure that all components of the cooling system are in good condition and operating correctly. The radiator must be clean to maintain the proper cooling and operating temperatures for the engine and transmission. Air clean the radiator, if necessary.
- The engine must be operating correctly. Be sure that it is correctly tuned and adjusted to the correct idle and maximum no-load governed speed specifications.

Hydraulic Checks

Also, before checking the transmission clutches, torque converter, charging pump, and hydraulic circuit for pressure and rate of oil flow, it is important to make the following transmission fluid checks:

- Check oil level in the transmission. The transmission fluid must be at the correct (full level).
- All clutches and the converter and its fluid circuit lines must be fully charged (filled) at all times.

NOTE:

The transmission fluid must be at operating temperature of 180-200°F / 82-93°C to obtain correct fluid level and pressure readings. NEVER attempt to make these checks with cold oil.

To raise the oil temperature to this specification it is necessary to either operate (work) the vehicle or run the engine with the converter at “stall” (see “Stall Test”, on page 47).

⚠CAUTION

Be careful the vehicle does not move unexpectedly when operating the engine and converter at stall rpm.

Troubleshooting Guide

Refer to the following troubleshooting guide for the diagnosis of typical transmission troubles.

Low Clutch Pressure

Cause	Remedy
Low oil level	Fill to proper level
Clutch pressure regulating valve stuck open	Clean valve spool and housing
Faulty charging pump	Replace pump
Broken or worn clutch shaft or piston sealing rings	Replace sealing rings
Clutch piston bleed valve stuck open	Clean bleed valves thoroughly

Low Charging Pump Output

Cause	Remedy
Low oil level	Fill to proper level
Suction screen plugged	Clean suction pump
Defective charging pump	Replace pump

Overheating

Cause	Remedy
Worn oil sealing rings	Remove, disassemble, & rebuild converter assembly
Worn charging pump	Replace charging pump
Low oil level	Fill to proper level
Dirty oil cooler	Clean cooler
Restriction in cooler lines	Change cooler lines

Noisy Converter

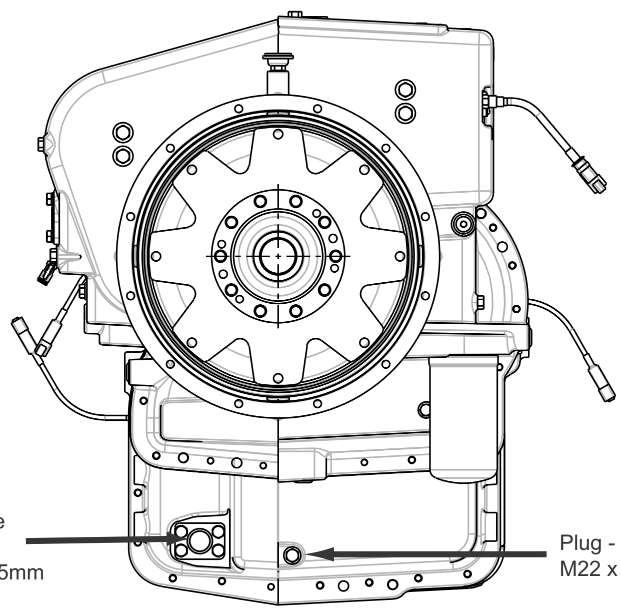
Cause	Remedy
Worn charging pump	Replace charging pump
Worn or damaged bearings	A complete disassembly will be necessary to determine which bearing is faulty
Defective charging pump	Replace pump

Lack of Power

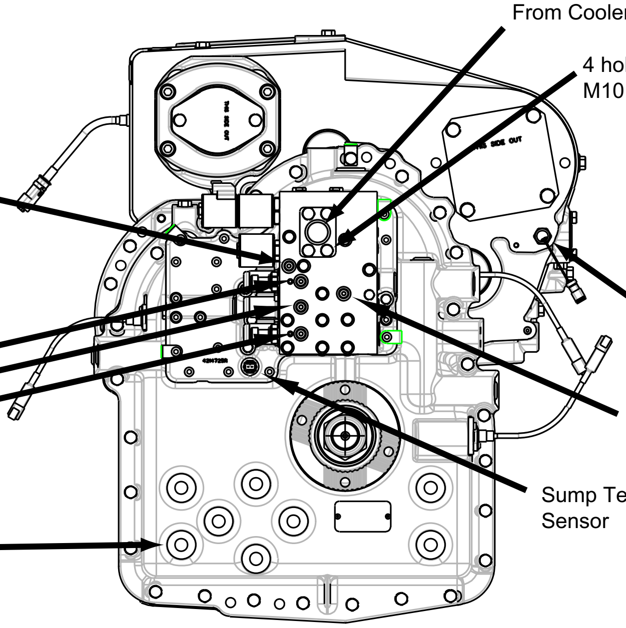
Cause	Remedy
Low engine RPM at converter stall	Tune engine check governor
See “Overheating” section above and make same checks	Make corrections as explained in “Overheating”

Check Points

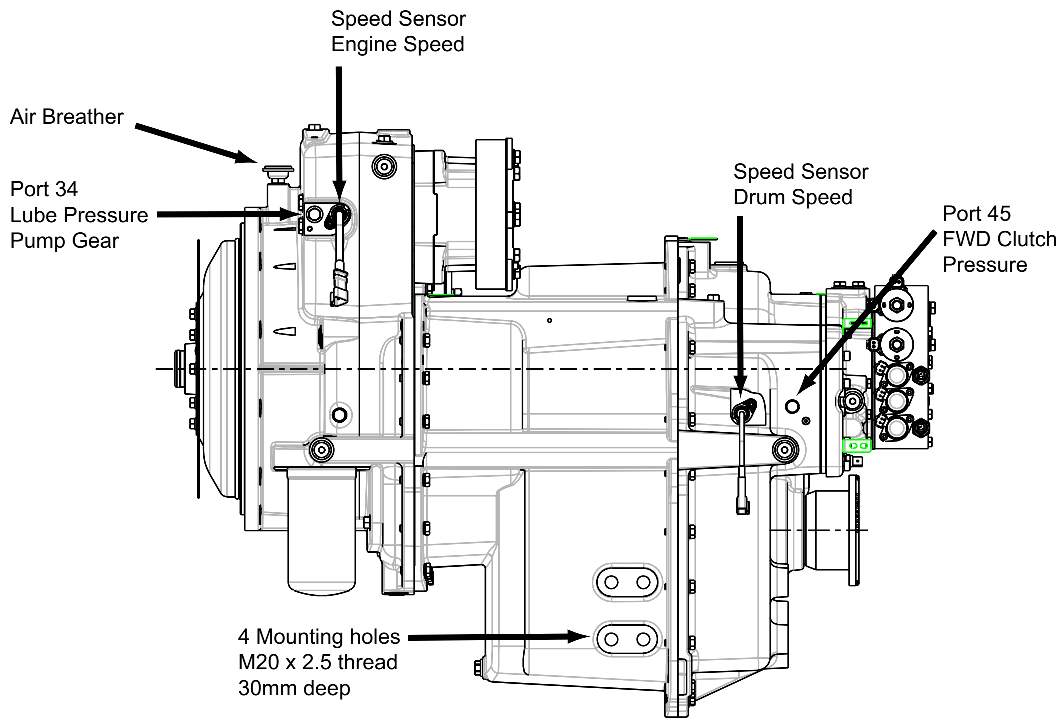
Front View



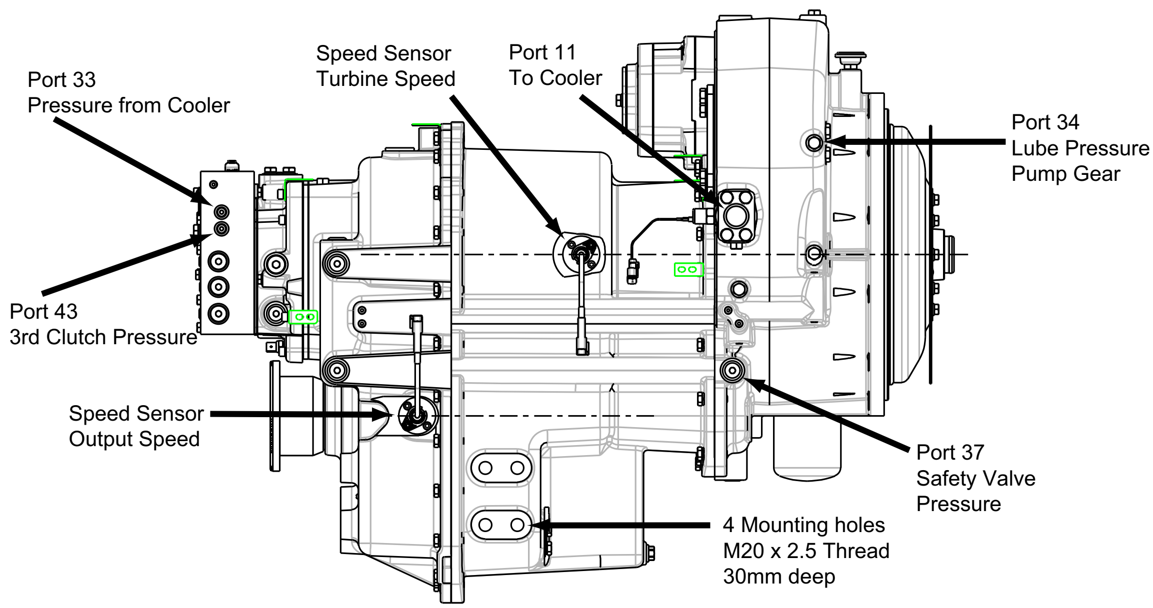
Rear View



Left View

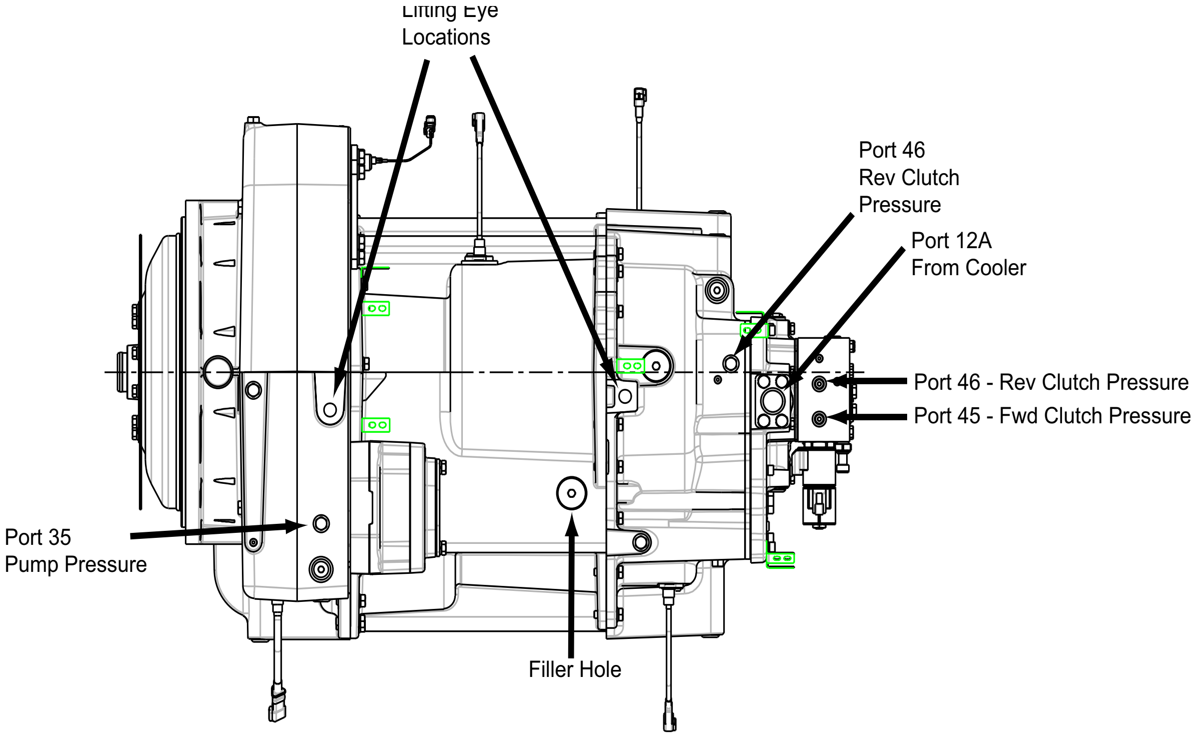


Right View

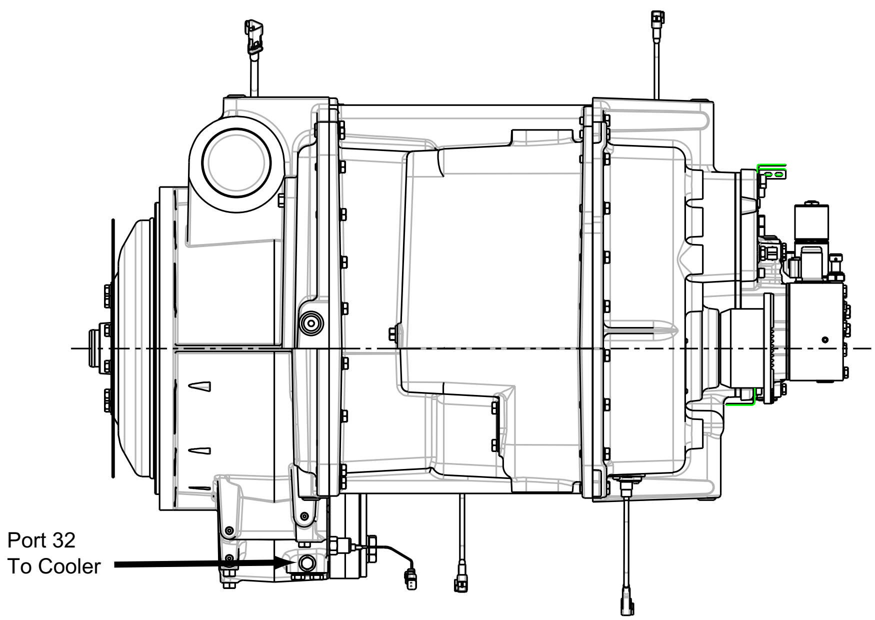


Check Points

Top View

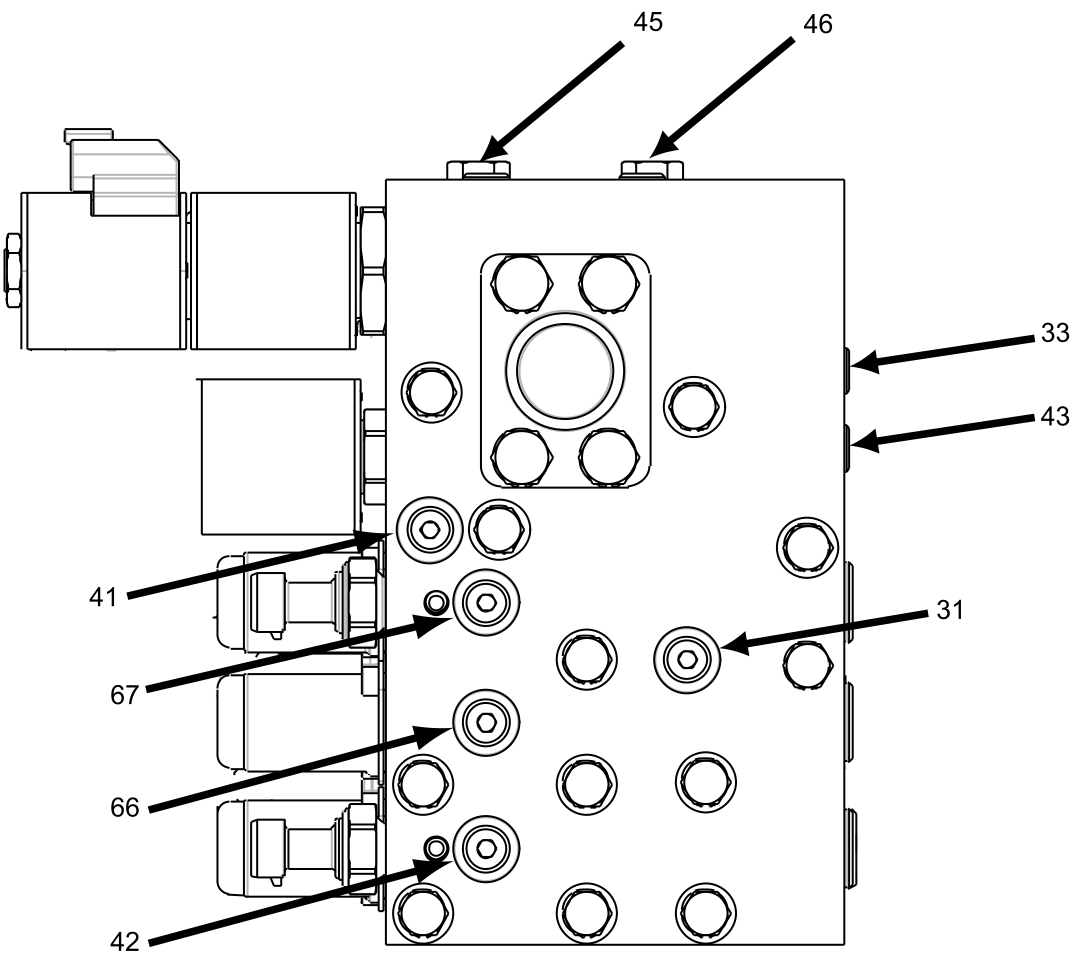


Bottom View

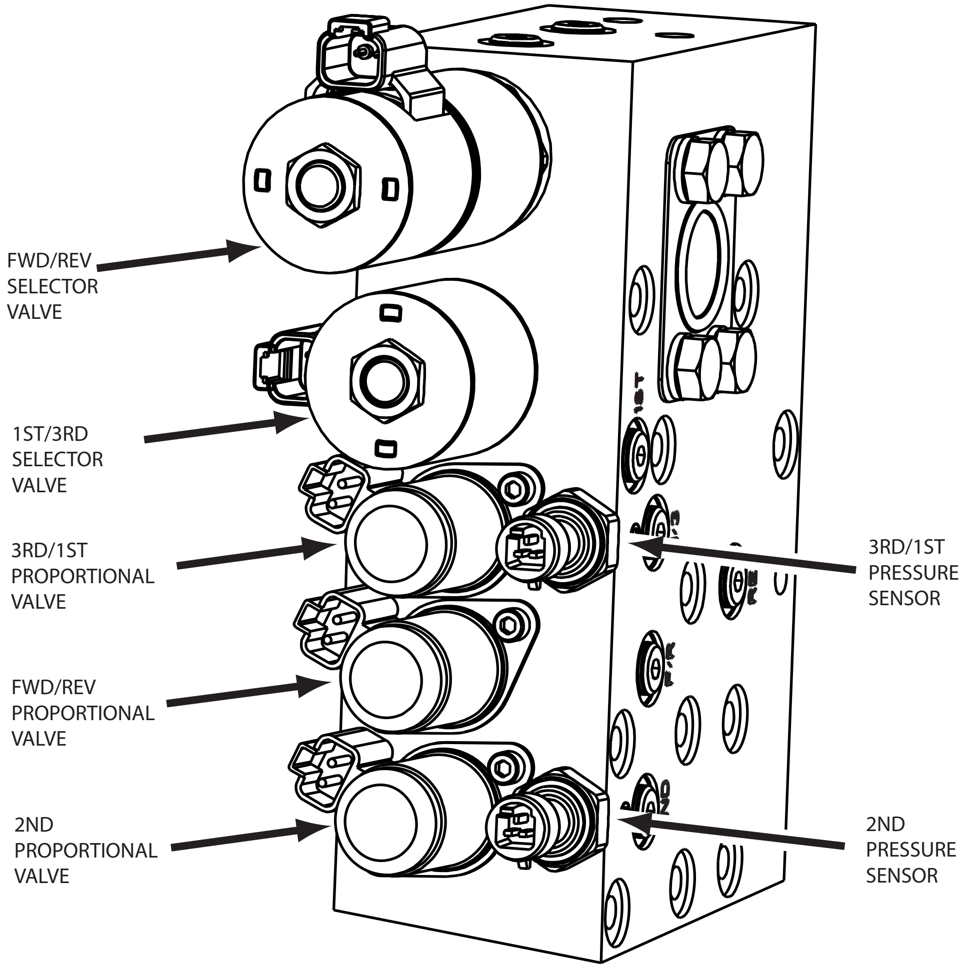


Checkpoints

31	System Pressure
41	1st Clutch Pressure
42	2nd Clutch Pressure
43	3rd Clutch Pressure
45	FWD Clutch Pressure
46	REV Clutch Pressure
66	FWD/REV Regulated Pressure
67	1st / 3rd Regulated Pressure



Full Flow Valve Components



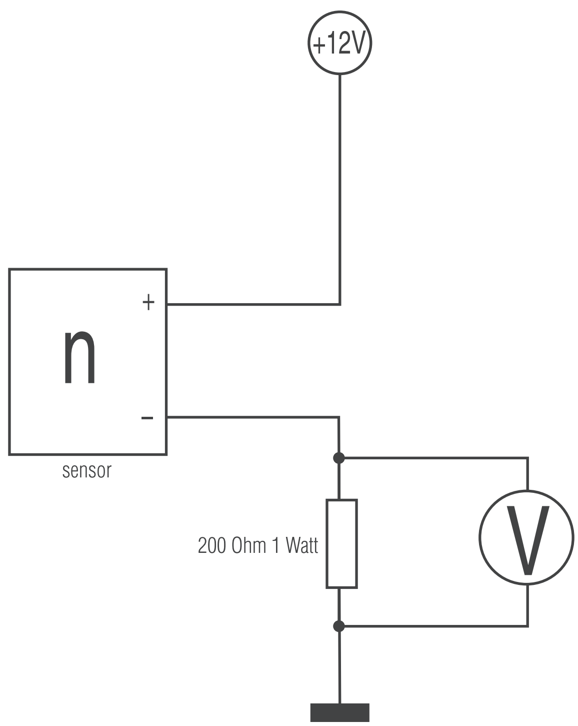
Speed Sensor - Static Standalone Test

In order to be able to sense the currents, a series resistor of e.g. 200 W must be used. This resistor is integrated in the controller, but when the sensor is to be tested, it must be connected externally.

The idea is to connect the sensor to an external power source and measure the DC voltage across the series resistor.

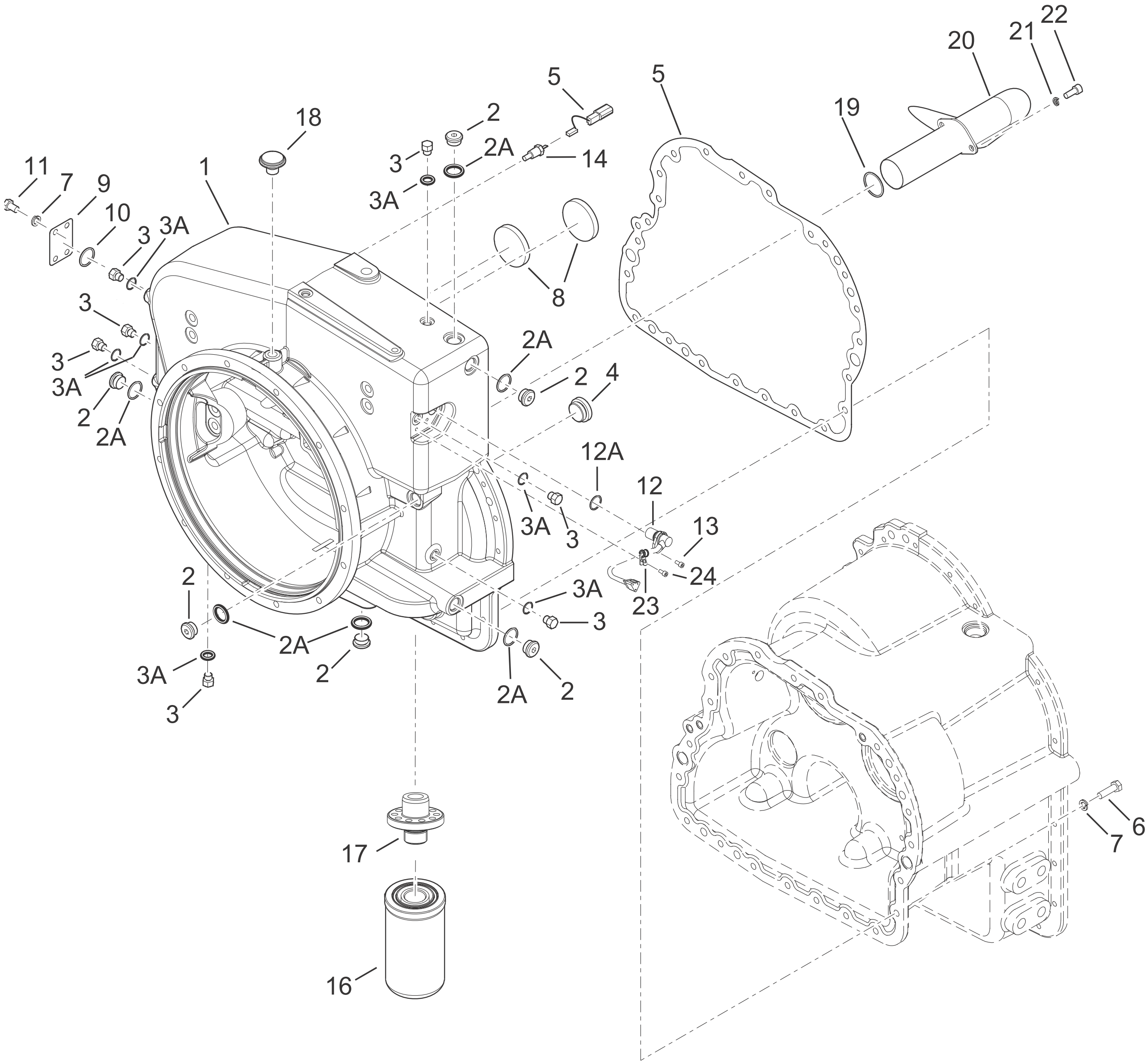
The voltage reading should be either 1.2V-1.6V (for the 7mA ± 1mA current level) or 2.6-3.0V (for the 14mA ± 1mA current level)

If the teeth can be moved slowly, distinct toggling between the two levels should be noticed.



EXPLODED VIEWS

Converter Housing Group

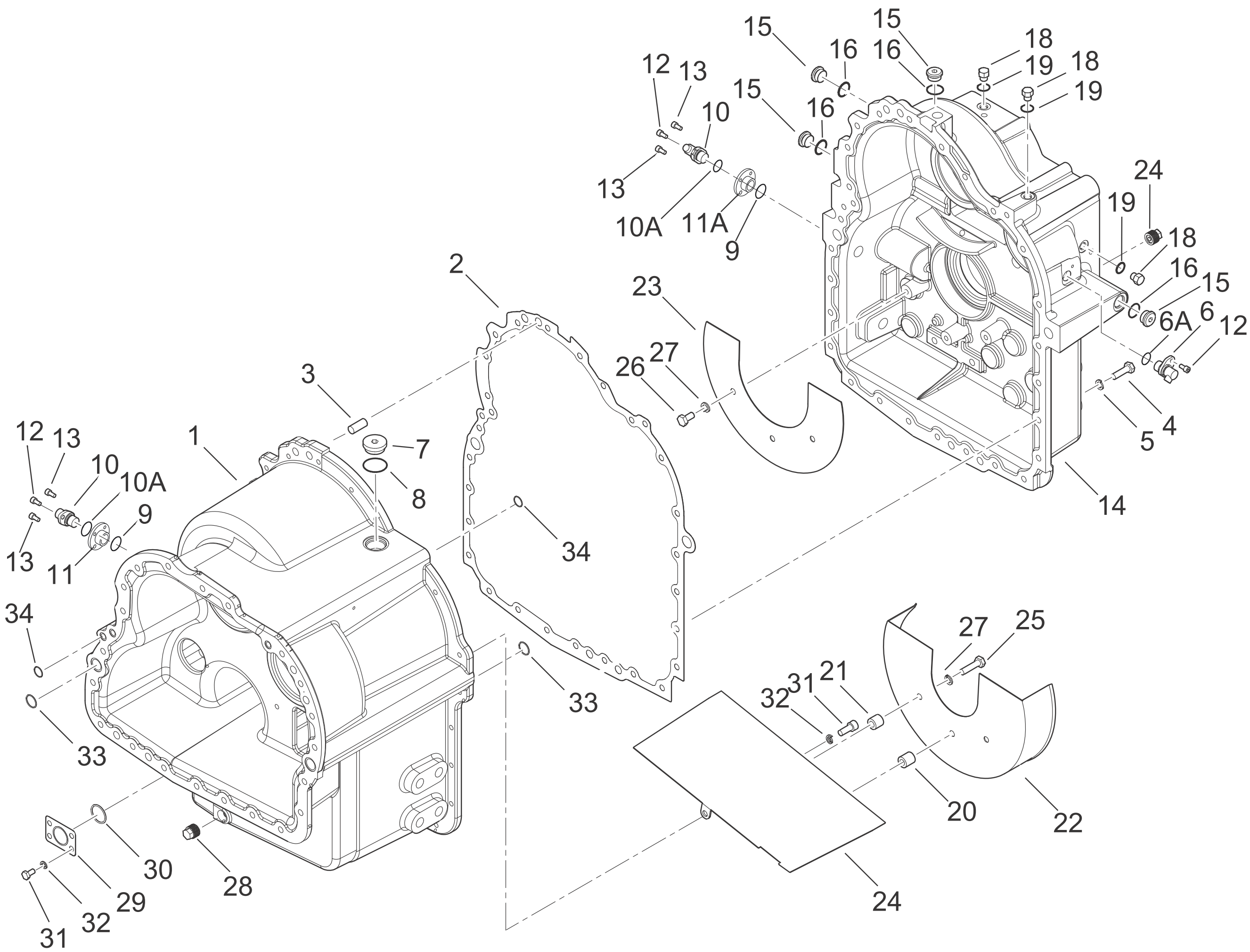


ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	HOUSING - CONVERTER ASSY INCLUDES ITEMS 2 - 4	1	12	SPEED SENSOR ASSY INCLUDES 12A	1
2	PLUG INCLUDES ITEM 2A	6	12A	O-RING	1
2A	O-RING (PART OF ITEM 2)	6	13	NOT USED ON THIS MODEL	
2B	PLUG - EXPANSION N.I.	7	14	SWITCH - TEMPERATURE	1
3	PLUG INCLUDES ITEM 3A	1	15	NOT USED ON THIS MODEL	
3A	O-RING (PART OF ITEM 3)	1	16	OIL FILTER ASSY	1
4	PLUG INCLUDES ITEM 4A	1	17	FILTER ADAPTER	1
4A	O-RING (PART OF ITEM 4)	1	18	AIR BREATHER	1
5	GASKET - CONVERTER HOUSING TO TRANSMISSION CASE	1	19	O-RING	1
6	CAPSCREW	21	20	SUCTION TUBE ASSY	1
7	LOCKWASHER	25	20A	SUCTION TUBE CLAMP N.I.	1
8	PLUG - EXPANSION	2	21	SCREW	2
9	COVER	1	22	Lockwasher	2
10	O-RING	1	23	Not Used On This Model	
11	CAPSCREW	4	24	Not Used On This Model	

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

Transmission Case & Rear Cover Group



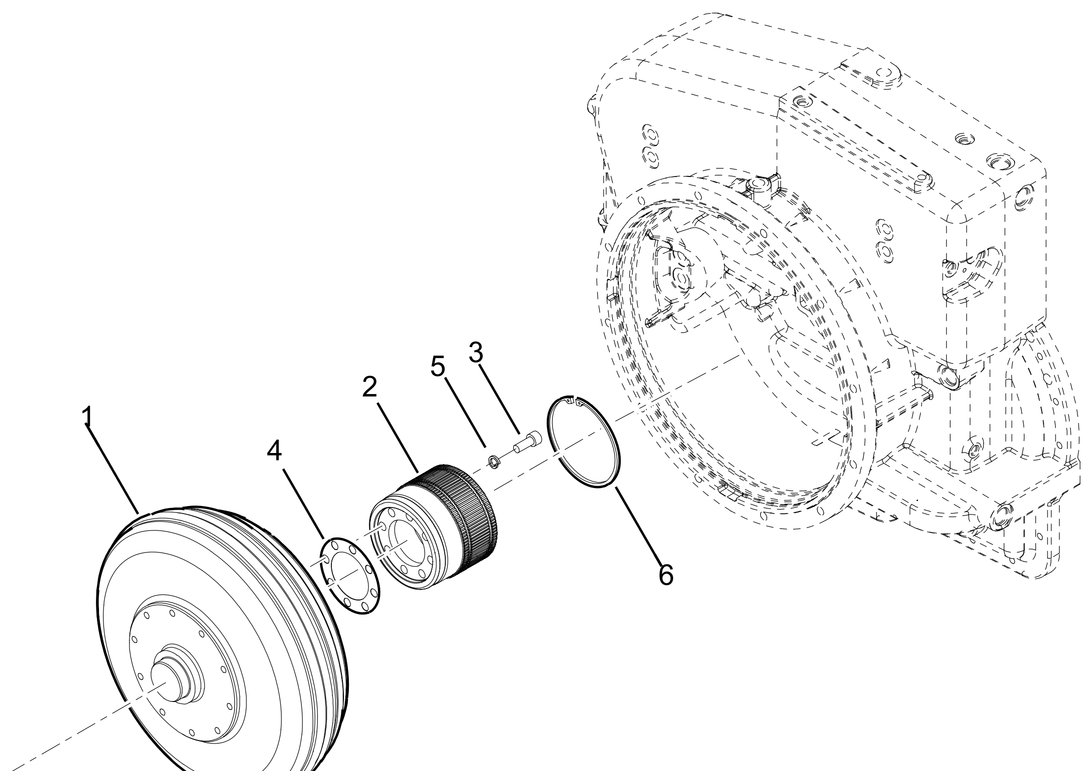
ITEM	DESCRIPTION	QTY
1	CASE-TRANSMISSION WITH EXTRA SUMP	1
2	GASKET-TRANS CASE TO REAR COVER	1
3	PIN-DOWEL	4
4	CAPSCREW	26
5	LOCKWASHER	26
6	ASSY-SPEED SENSOR - INCLUDING ITEM 6A	1
6A	O-RING-SPEED SENSOR - PART OF ITEM 6	1
7	PLUG-INCLUDING ITEM 8	1
8	O-RING - PART OF ITEM 7	1
9	O-RING FILTER ADAPTER	2
10	ASSY-SPEED SENSOR - INCLUDING ITEM 10A	2
10A	O-RING-SPEED SENSOR - PART OF ITEM 10A	1
11	BUSHING-SPEED SENSOR FOR 71T OUTPUT GEAR	1
11A	BUSHING-SPEED SENSOR FOR 92 TEETH GEAR	1
12	SCREW - PART OF ITEM 6 AND 10	3
13	CAPSCREW	4
14	ASSY-REAR COVER PLUGS-INCL. ITEMS 15 THRU 19	1
15	PLUG M22X1,5 - INCL.ITEM 16 & PART OF ITEM 14	4
16	O-RING - PART OF ITEM 15	4
	EXPANSIONPLUG - PART OF ITEM 14 N.I.	4
18	PLUG-INCLUDING ITEM 19 & PART OF ITEM 14	3

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

ITEM	DESCRIPTION	QTY
19	O-RING-PART OF ITEM 18	3
20	SPACER-OIL BAFFLE	1
21	SPACER-OIL BAFFLE	2
22	BAFFLE-OIL	1
23	COVER-OIL BAFFLE	1
24	BAFFLE-OIL	1
25	CAPSCREW	3
26	CAPSCREW	3
27	LOCKWASHER	6
28	PLUG-MAGNETIC DRAIN	1
29	COVER-SPLIT FLANGE SHIPPING	1
30	O-RING	1
31	CAPSCREW	5
32	LOCKWASHER	5
33	O-RING	4
34	O-RING	6
	SCREW N.I.	1
	PLAIN WASHER N.I.	1
	PLAIN WASHER N.I.	1
	BRACKET N.I.	4

Torque Converter Group

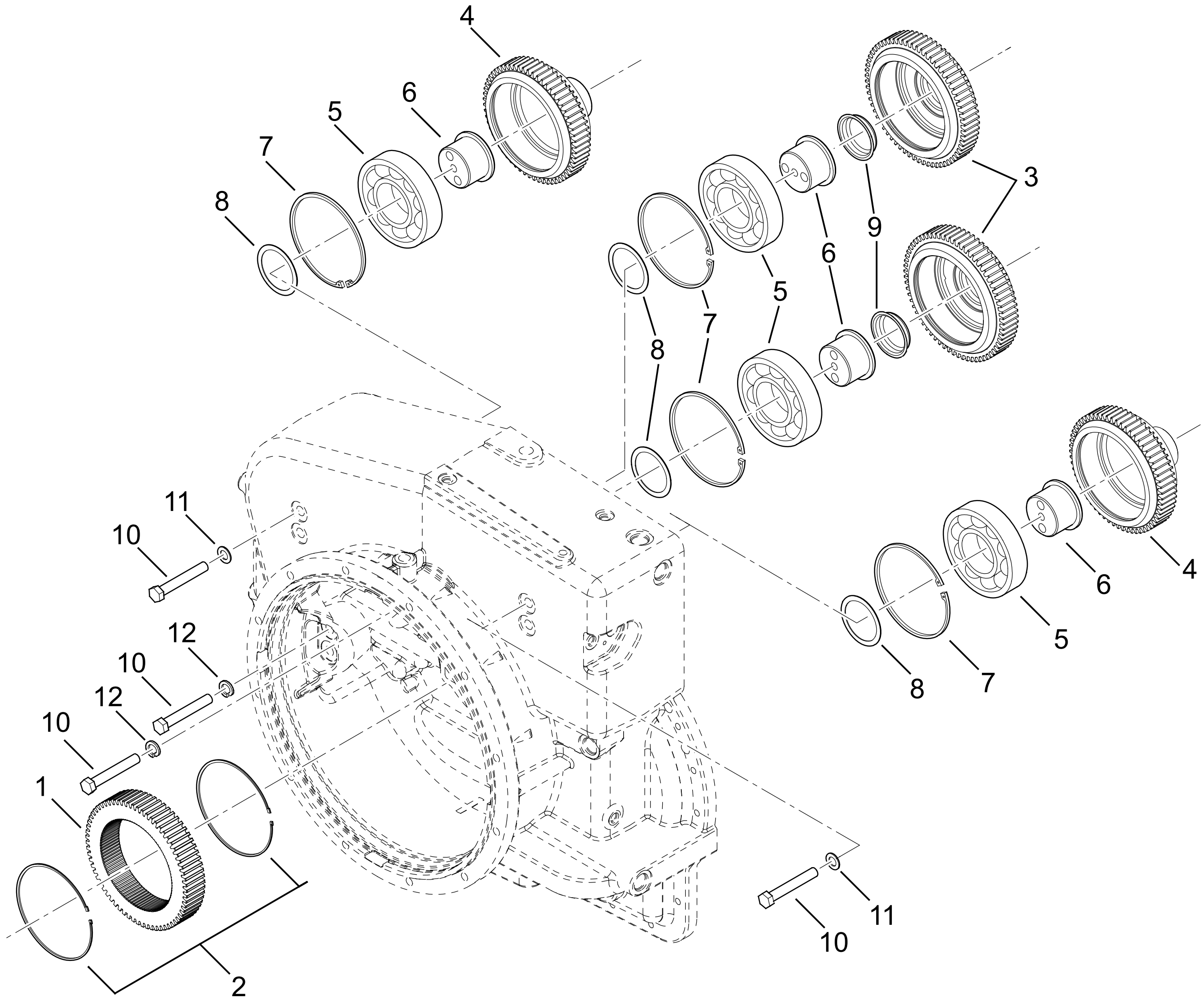


ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	TORQUE CONVERTER ASSY - INCL. ITEMS 2 THRU 5	1	4	GASKET-TORQUE CON-VERTER - PART OF ITEM 1	1
2	GEAR-TORQUE CONVERTER - PART OF ITEM 1	1	5	LOCKWASHER - PART OF ITEM 1	1
3	SCREW - PART OF ITEM 1	8	6	NOT USED ON THIS MODEL	

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

Pump Drive Group

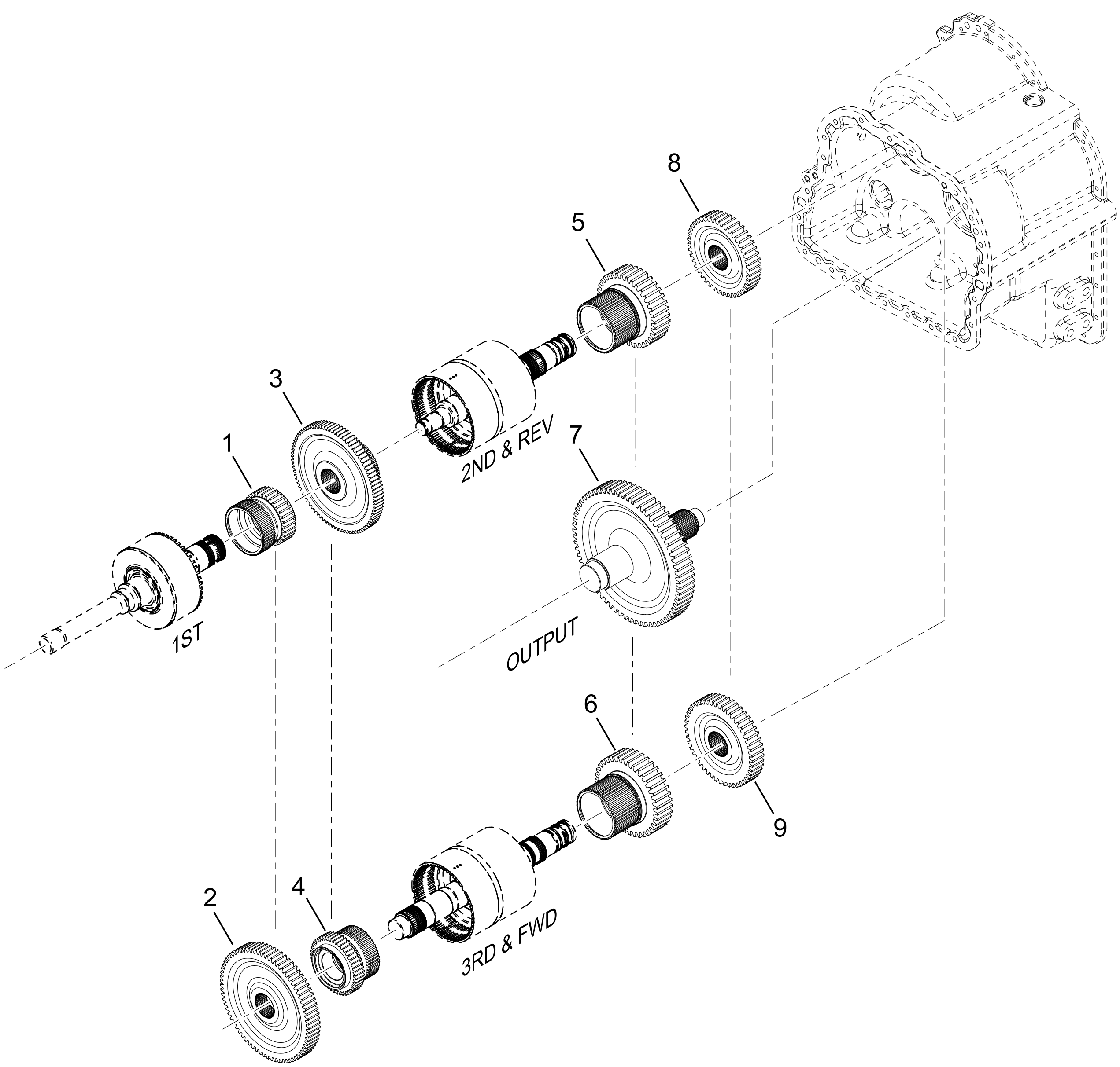


ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	NOT USED ON THIS MODEL		7	SNAP RING	4
2	NOT USED ON THIS MODEL		8	NOT USED ON THIS MODEL	
3	GEAR-PUMP DRIVE IDLER 66T	2	9	PLUG	2
4	GEAR-PUMP DRIVE 61T	2	10	CAPSCREW	8
5	BEARING 6311 C3	4	11	WASHER-SEAL	4
6	SUPPORT-PUMP DRIVE BEAR-ING	4	12	LOCKWASHER	4

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

Gear Group



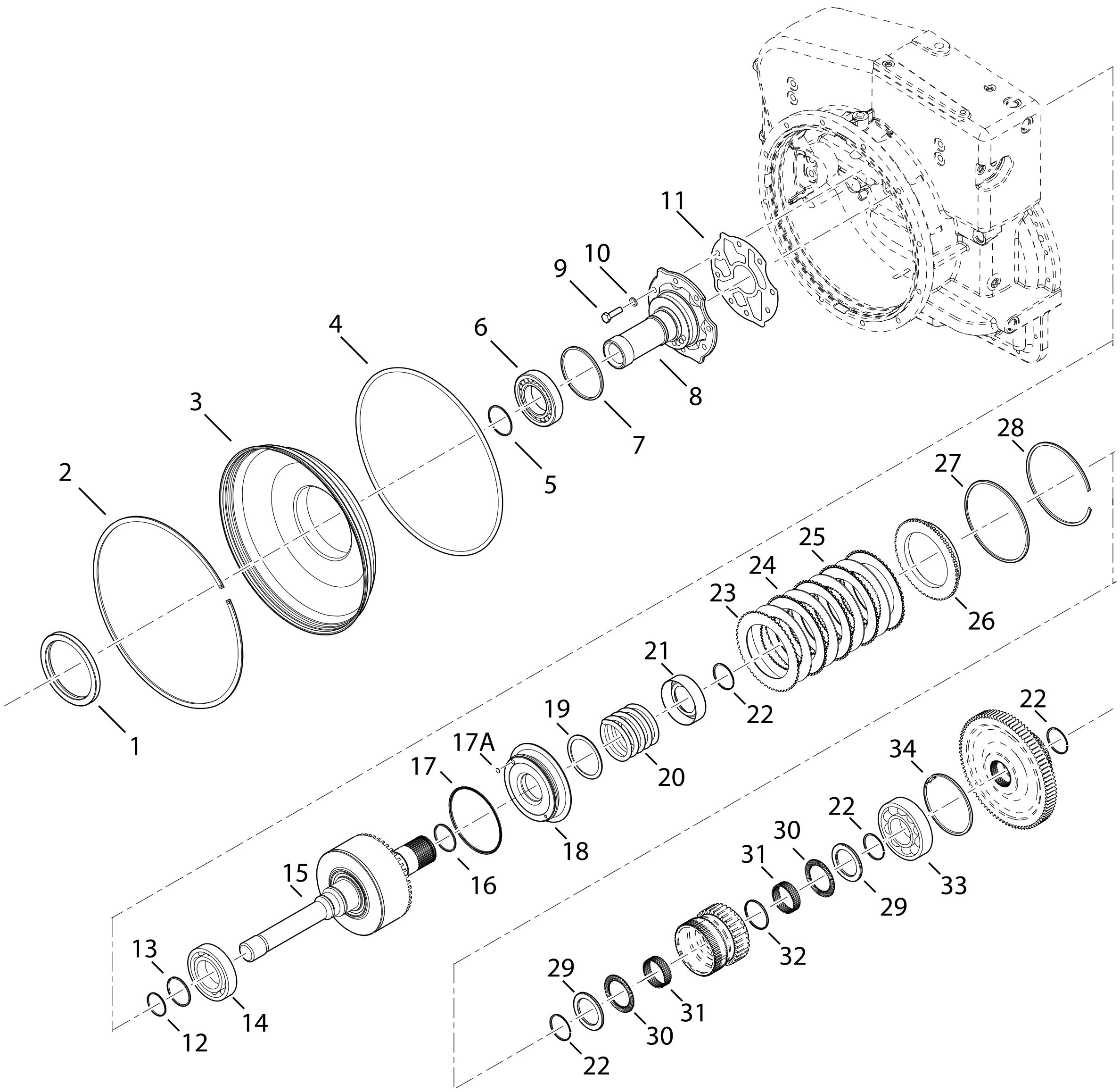
ITEM	DESCRIPTION	QTY
1	GEAR-CLUTCH 1ST	1
2	GEAR	1
3	GEAR-CLUTCH 2ND	1
4	GEAR-CLUTCH 3RD	1
5	GEAR-REV CLUTCH	1

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

ITEM	DESCRIPTION	QTY
6	GEAR-FWD CLUTCH	1
7	SHAFT-OUTPUT 71T	1
8	GEAR	1
9	GEAR	1

Input Shaft & 1st Group



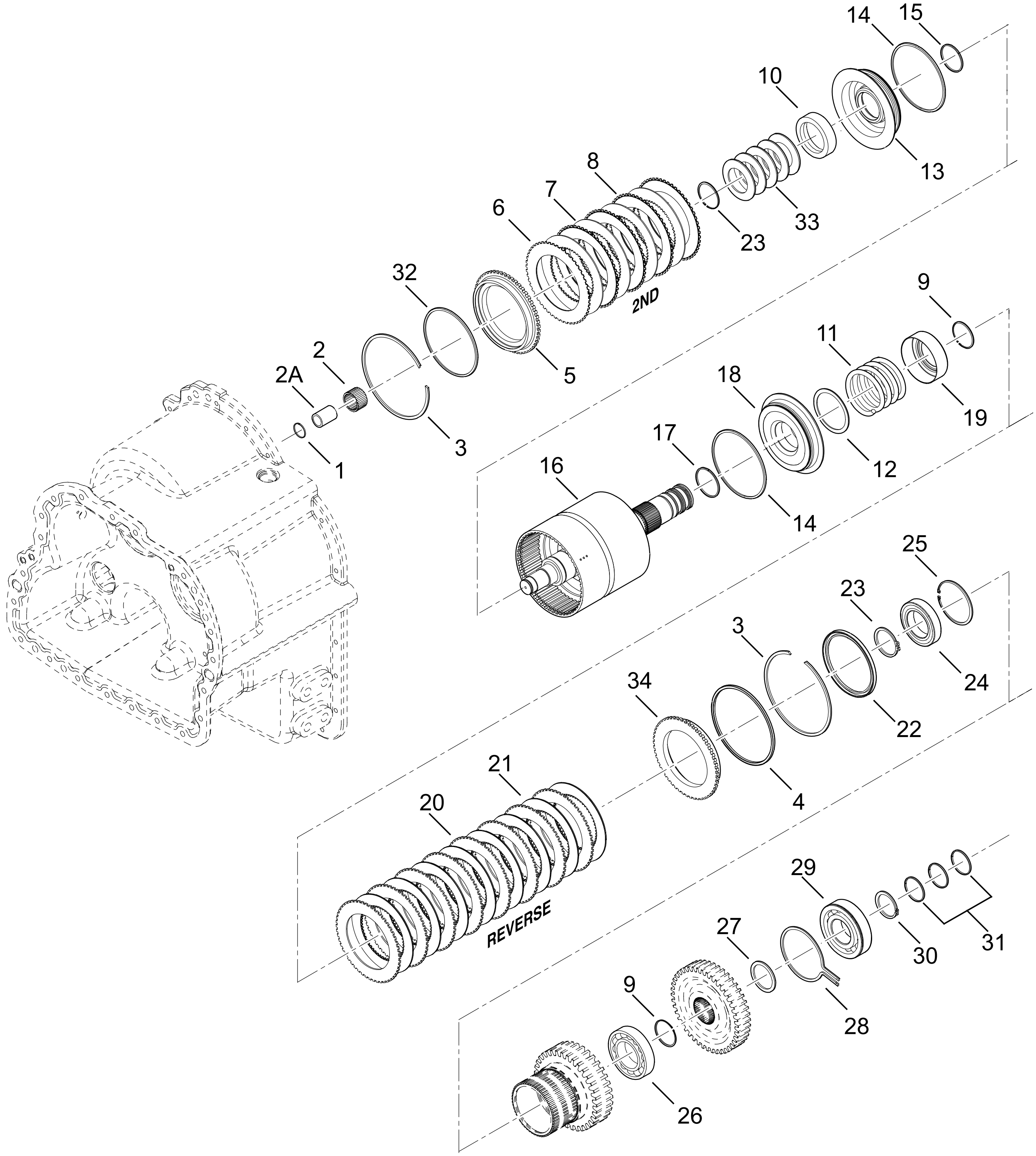
ITEM	DESCRIPTION	QTY
1	SEAL-OIL BAFFLE INNER - PART OF ITEM 3	1
2	SNAP RING	1
3	ASSY- OIL BAFFLE AND SEAL- INCLUDING ITEM 1	1
4	O-RING	1
5	RING-SNAP DIA 60	1
6	BEARING-TORQUE CON-VERTER NU212 ECJ	1
7	RING-PISTON	1
8	SUPPORT-STATOR	1
8A	BUSHING	
9	LOCKWASHER	8
10	CAPSCREW	8
11	GASKET-STATOR SUPPORT	1
12	RING-PISTON	1
13	RING-PISTON	1
14	BEARING (BALL)	1
15	ASSY-SHAFT AND HUB 1ST	1
16	RING-PISTON 56 X 2,5	1
17	SEAL-OUTER- PART OF ITEM 18	1
17A	SCREEN - PART OF ITEM 18	1

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

ITEM	DESCRIPTION	QTY
18	ASSY-CLUTCH PISTON 1ST-INCL ITEMS 17 & 17A	1
19	SPACER-CLUTCH PISTON SPRING	1
20	SPRING-PISTON RETURN	1
21	SPRING-RETAINER	1
22	SNAP RING-EXTERNAL	4
23	DISC-CLUTCH OUTER HALF	2
24	DISC-CLUTCH OUTER	4
25	DISC-CLUTCH INNER	5
26	PLATE-END	1
27	NOT USED ON THIS MODEL	
28	SNAP RING	1
29	WASHER-THRUST 78X55X5	1
30	BEARING-NEEDLE ROLLER	2
31	BEARING K55X60X17XFV1C	2
32	SPACER	1
33	BEARING 6311 C3	1
34	SNAP RING	1
35	WASHER-THRUST WS.81111	1

Reverse & 2nd Group

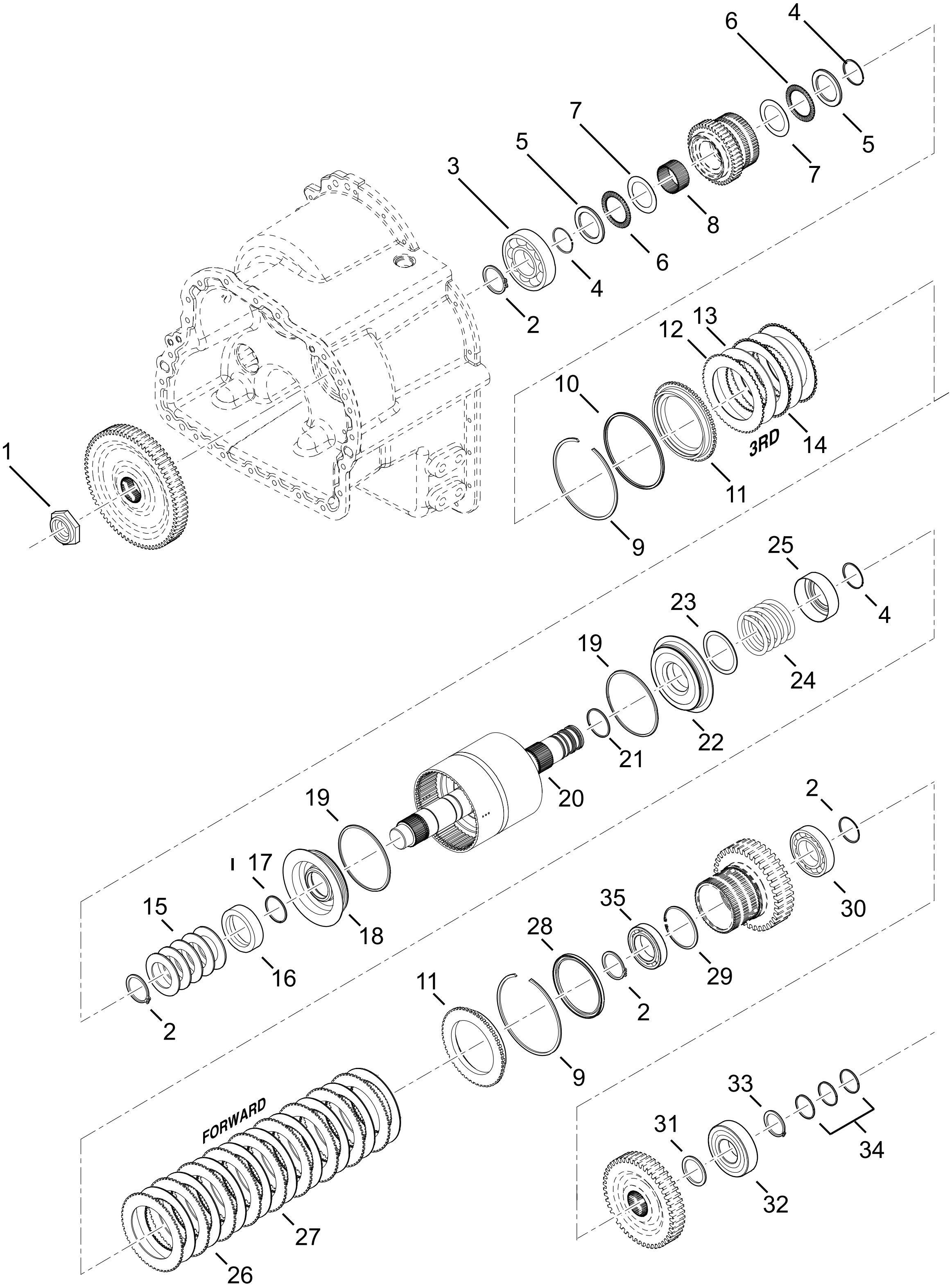


ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	RING-PISTON	1	17	RING-PISTON	1
2	BEARING HK3026	1	18	ASSY-CLUTCH PISTON REV - INCL ITEM 13A & 14	1
2A	BUSHING	1	19	RETAINER-SPRING	1
3	SNAP RING	2	20	DISC-CLUTCH OUTER REV	10
4	NOT USED ON THIS MODEL		21	DISC-CLUTCH INNER REV	10
5	PLATE-END 2ND	1	22	SEAL LIP END PLATE	1
6	DISC-CLUTCH OUTER HALF 2ND	2	23	RING-RETAINING	2
7	DISC-CLUTCH INNER 2ND	6	24	BEARING CLUTCH DRIVEN GEAR	1
8	DISC-CLUTCH OUTER 2ND	5	25	RING-SNAP	1
9	SNAP RING-EXTERNAL	2	26	REAR BEARING	1
10	SPACER-CLUTCH PISTON SPRING	1	27	WASHER-BEARING SUPPORT	1
11	SPRING- RETURN	1	28	SNAP RING EXTERNAL-SPECIAL	1
12	SPACER	1	29	BEARING-BALL	1
13	ASSY-CLUTCH PISTON 2ND-INCL ITEM 13A & 14	1	30	RETAINING RING	1
13A	SCREEN - PART OF ITEM 13		31	RING-PISTON	3
14	SEAL-OUTER 2ND - PART OF ITEM 13	1	32	NOT USED ON THIS MODEL	
15	RING-PISTON 56 X 2,5	1	33	SPRING-BELLEVILLE GENERATION II	1
16	ASSY-REV & 2ND SHAFT, HUB, DRUM, TUBE & PLUG	1	34	PLATE-END REV	1

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

Forward & 3rd Group

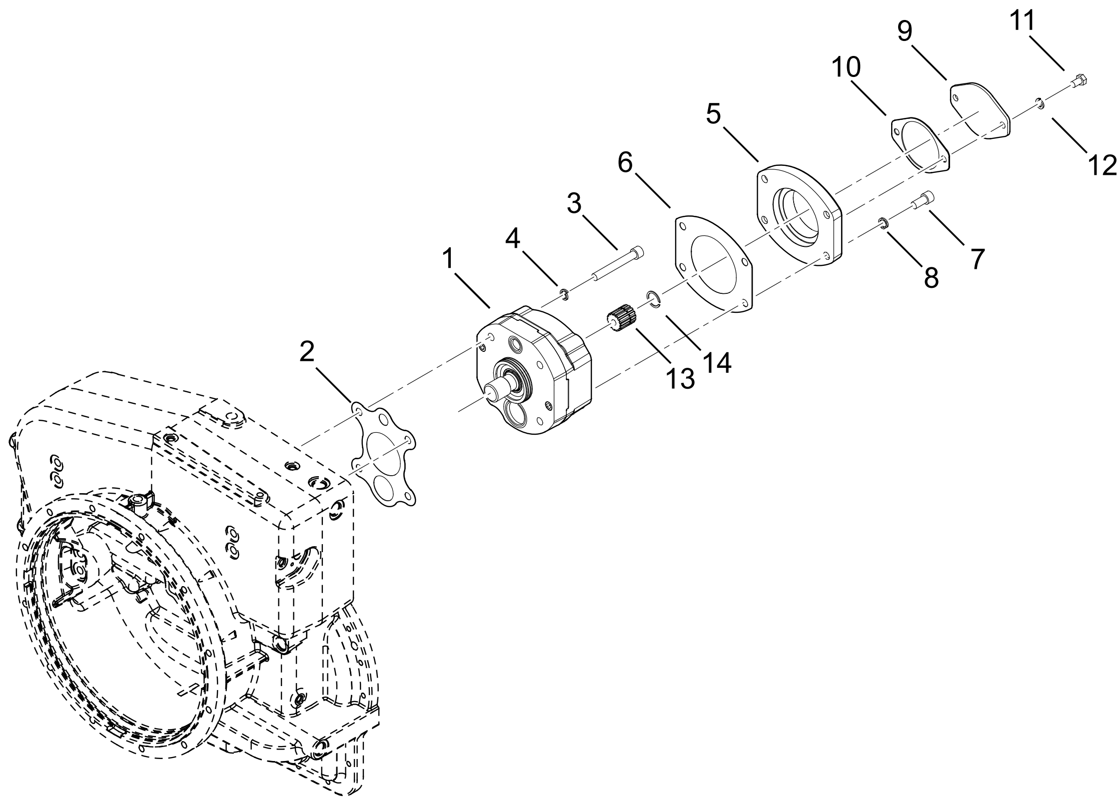


ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	LOCK NUT	1	18A	SCREEN - PART OF ITEM 18 AND 22	1
2	RING-RETAINING	3	19	SEAL-OUTER FWD AND 3RD-PART OF ITEM 18 OR 22	1
3	BEARING 6311 C3	1	20	ASSY-SHAFT, HUB , DRUM AND PLUGS FWD&3RD	1
4	SNAP RING-EXTERNAL	4	21	RING-PISTON	1
5	WASHER-THRUST 78X55X5	1	22	ASSY-CLUTCH PISTON FWD	1
6	THRUST BEARING	2	23	SPACER-CLUTCH PISTON SPRING	1
7	NOT USED ON THIS MODEL		24	SPRING-PISTON RETURN	1
8	BEARING-NEEDLE ROLLER 60X55X30	1	25	RETAINER-SPRING	1
9	SNAP RING	2	26	DISC-CLUTCH INNER FWD	11
10	WASHER-THRUST WS.81111	1	27	DISC-CLUTCH OUTER FWD	11
11	PLATE-END FWD	1	28	SEAL-LIP	1
11A	PLATE-END 3RD	1	29	RING-SNAP	1
12	DISC-CLUTCH OUTER HALF 3RD	2	30	REAR BEARING	1
13	DISC-CLUTCH INNER 3RD	4	31	WASHER-BEARING SUP-PORT	1
14	DISC-CLUTCH OUTER 3RD	3	32	BEARING	1
15	ASSY-SPRING DISC - INCLUDING 5 WASHERS	1	33	RETAINING RING	1
16	SPACER-CLUTCH PISTON SPRING 3RD	1	34	RING-PISTON	3
17	RING-PISTON 56 X 2,5	1	35	BEARING CLUTCH DRIVEN GEAR	1
18	ASSY-CLUTCH PISTON 3RD-INCL ITEMS 18A & 19	1			

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

Charging Pump Group

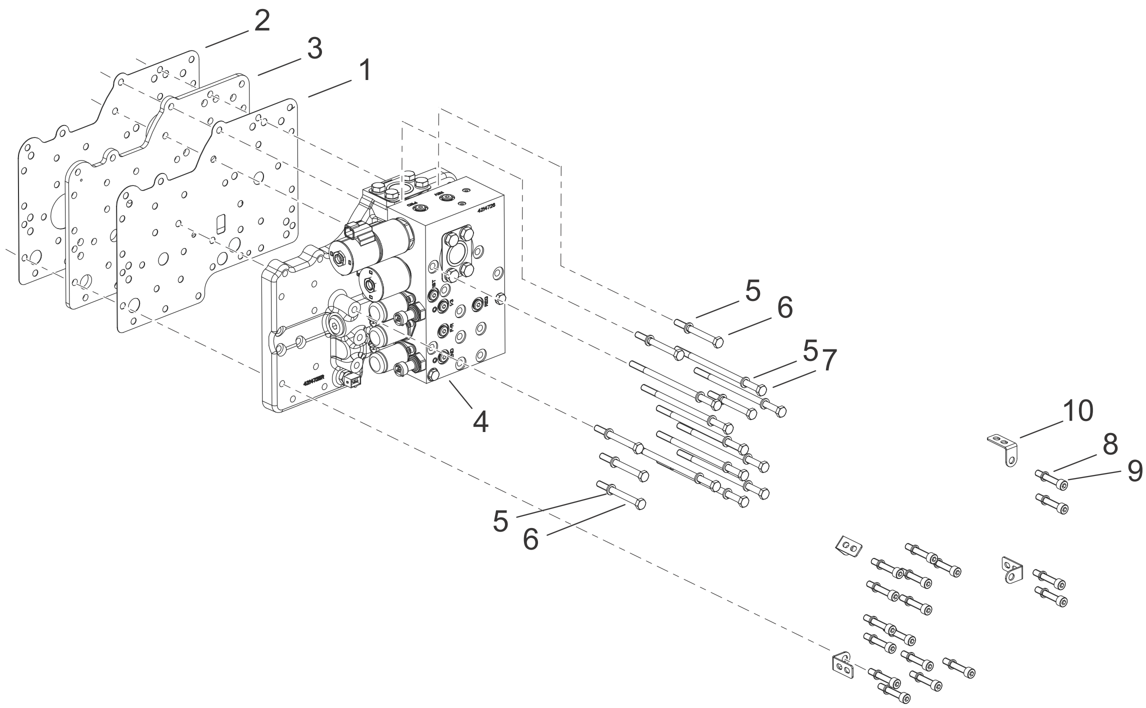


ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	CHARGING PUMP	1	10	GASKET-SHIPPING COVER SAE C	1
2	NOT USED ON THIS MODEL		11	SCREW	4
3	CAPSCREW	4	12	LOCKWASHER	4
4	LOCKWASHER	4	13	NOT USED ON THIS MODEL	
5	ADAPTOR-CHARGING PUMP SAE C	1	14	NOT USED ON THIS MODEL	
6	GASKET-ADAPTOR	1	15	O-RING	1
7	SCREW ADAPTER TO CHARGING PUMP	4	16	O-RING 50 X 2,5	1
8	LOCKWASHER	4	17	O-RING 30 X 3	1
9	COVER-SHIPPING SAE C	1			

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

Control Valve Group - Part I

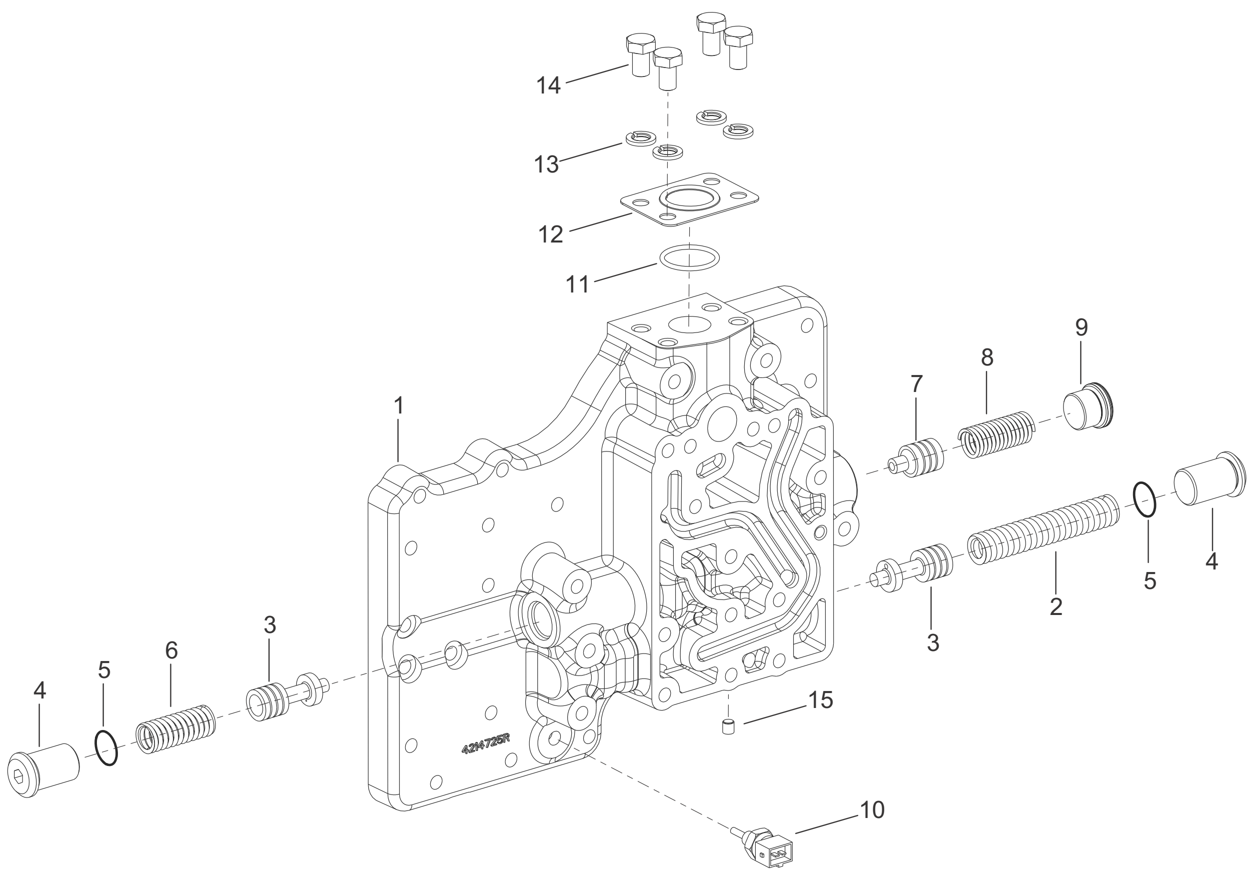


ITEM	DESCRIPTION	QTY
1	GASKET-CONTROL VALVE	1
2	GASKET-DISTRIBUTION PLATE TO REAR COVER	1
3	PLATE-SEPERATOR	1
4	ASSY-CONTROL VALVE	1
5	LOCKWASHER	16
6	SCREW	6
7	SCREW	10
8	LOCKWASHER	18
9	CAPSCREW	18
10	BRACKET	4

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

Regulator Body Assembly



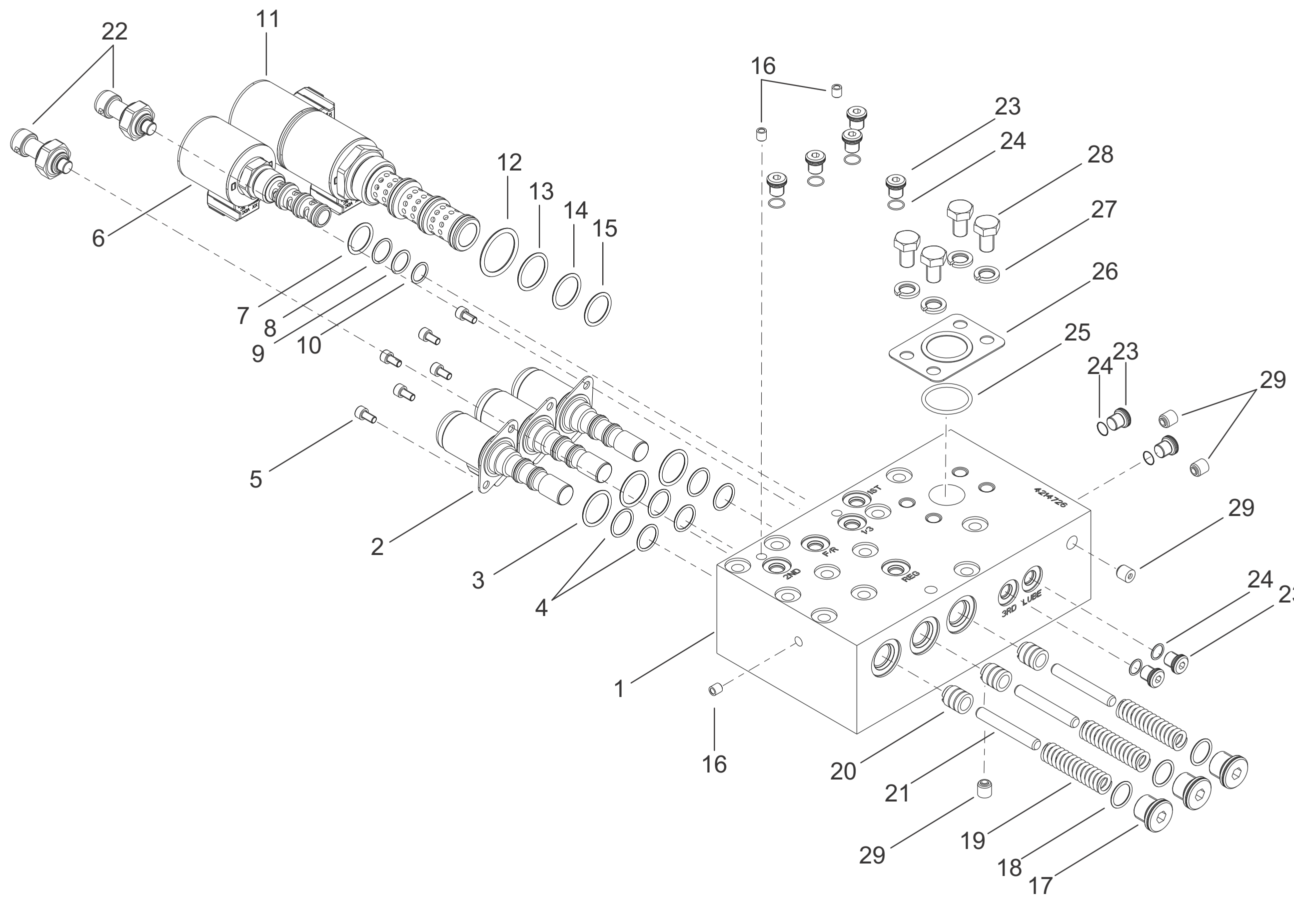
ITEM	DESCRIPTION	QTY
1	BODY-REGULATOR VALVE	1
2	SPRING	1
3	SPOOL-PRESSURE REGULA-TOR	2
4	PLUG M22 X 1,5 - INCLUDING ITEM 5	2
5	O-RING - PART OF ITEM 4	2
6	SPRING-SAFETY VALVE	1
7	SPOOL-CONV BYPASS	1
8	SPRING-CONV BYPASS	1

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

ITEM	DESCRIPTION	QTY
9	PLUG-O-RING ISO 6149	1
10	SENSOR-TEMPERATURE	1
11	O-RING POLYACRYLATE	1
12	COVER-SPLIT FLANGE	1
13	WASHER-SPRING LOCK	4
14	SCREW HEXAGON HEAD CAP	4
15	PLUG-EXPANSION	1

Full Flow Valve Assembly Group

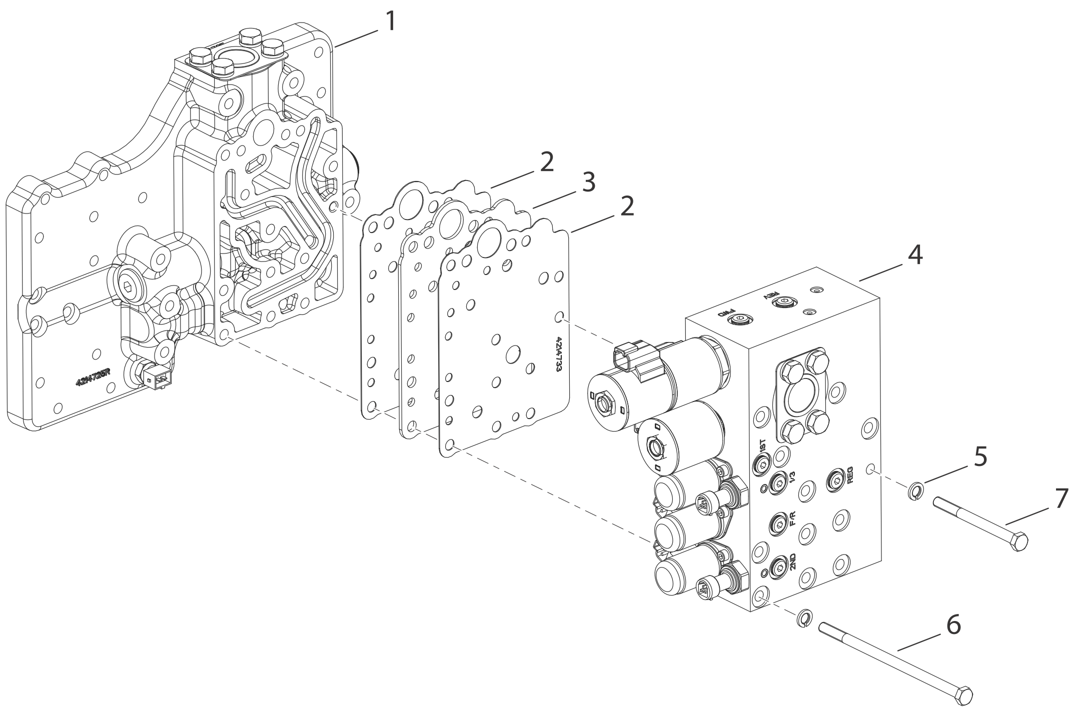


ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	BODY-FULL FLOW VALVE	1	16	PLUG-EXPANSION	3
2	SOLENOID-VALVE - INCLUD-ING ITEMS 3 & 4	3	17	PLUG-O-RING - INCLUDING ITEM 18	3
3	O-RING - PART OF ITEM 2	3	18	O-RING - PART OF ITEM 17	3
4	O-RING - PART OF ITEM 2	6	19	SPRING-ACCUMULATOR	3
5	SCREW HEXAGON SOCKET CAP	6	20	SPOOL-ACCUMULATOR	3
6	ASSEMBLY-SOLENOID 24V-INCL ITEMS 7 THRU 10	1	21	PIN-ACCUMULATOR STOP	3
7	O-RING - PART OF ITEM 6	1	22	SENSOR-VALVE PRES-SURE	2
8	O-RING - PART OF ITEM 6	1	23	PLUG-O-RING - INCLUDING ITEM 24	9
9	O-RING - PART OF ITEM 6	1	24	O-RING - PART OF ITEM 23	9
10	O-RING - PART OF ITEM 6	1	25	O-RING POLYACRYLATE	1
11	ASSEMBLY-SOLENOID 24V-INCL ITEMS 12 THRU 15	1	26	COVER-SPLIT FLANGE	1
12	O-RING - PART OF ITEM 11	1	27	WASHER-SPRING LOCK	4
13	O-RING - PART OF ITEM 11	1	28	SCREW HEXAGON HEAD CAP	4
14	O-RING - PART OF ITEM 11	1	29	PLUG-EXPANSION	4
15	O-RING - PART OF ITEM 11	1			

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

Control Valve Group - Part II

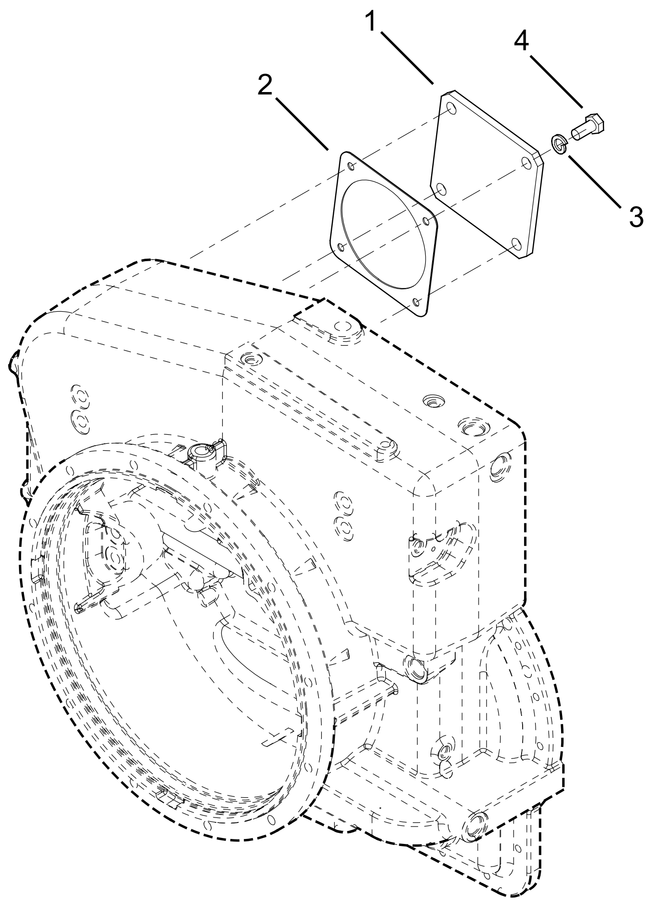


ITEM	DESCRIPTION	QTY
1	ASSY-REGULATOR BODY	1
2	GASKET-CONTROL VALVE	2
3	PLATE-SEPERATOR	1
4	ASSY-FULL FLOW VALVE 24V	1
5	LOCKWASHER	2
6	SCREW	1
7	CAPSCREW	1

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

Shipping Cover Group

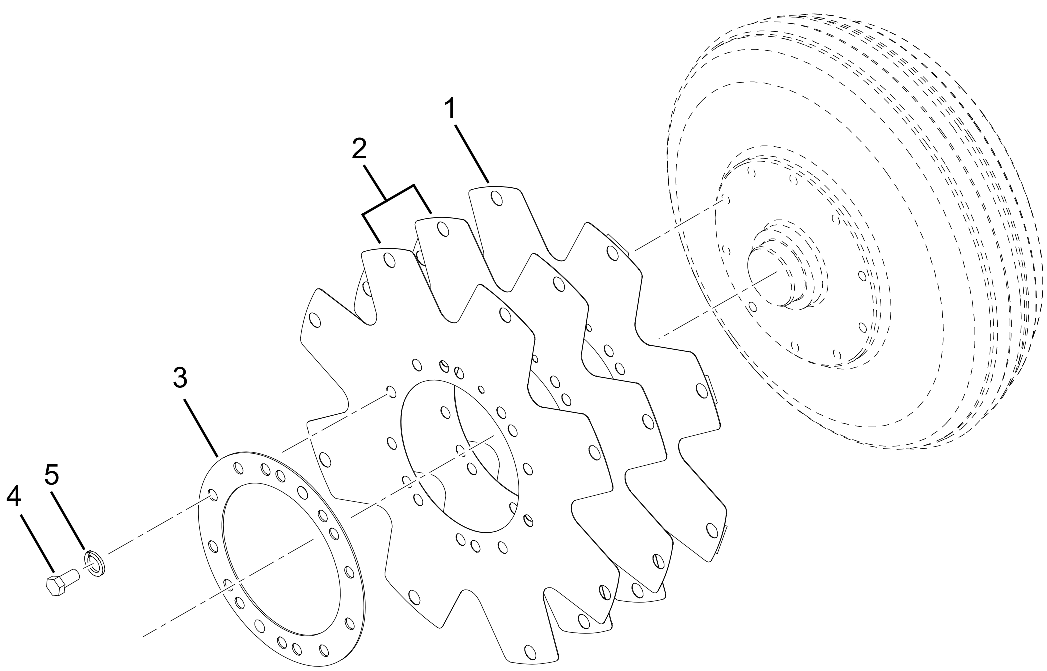


ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	COVER-SHIPPING SAE C	1	3	LOCKWASHER	4
2	GASKET-SHIPPING COVER SAE C	1	4	SCREW	4

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

Drive Plate Group



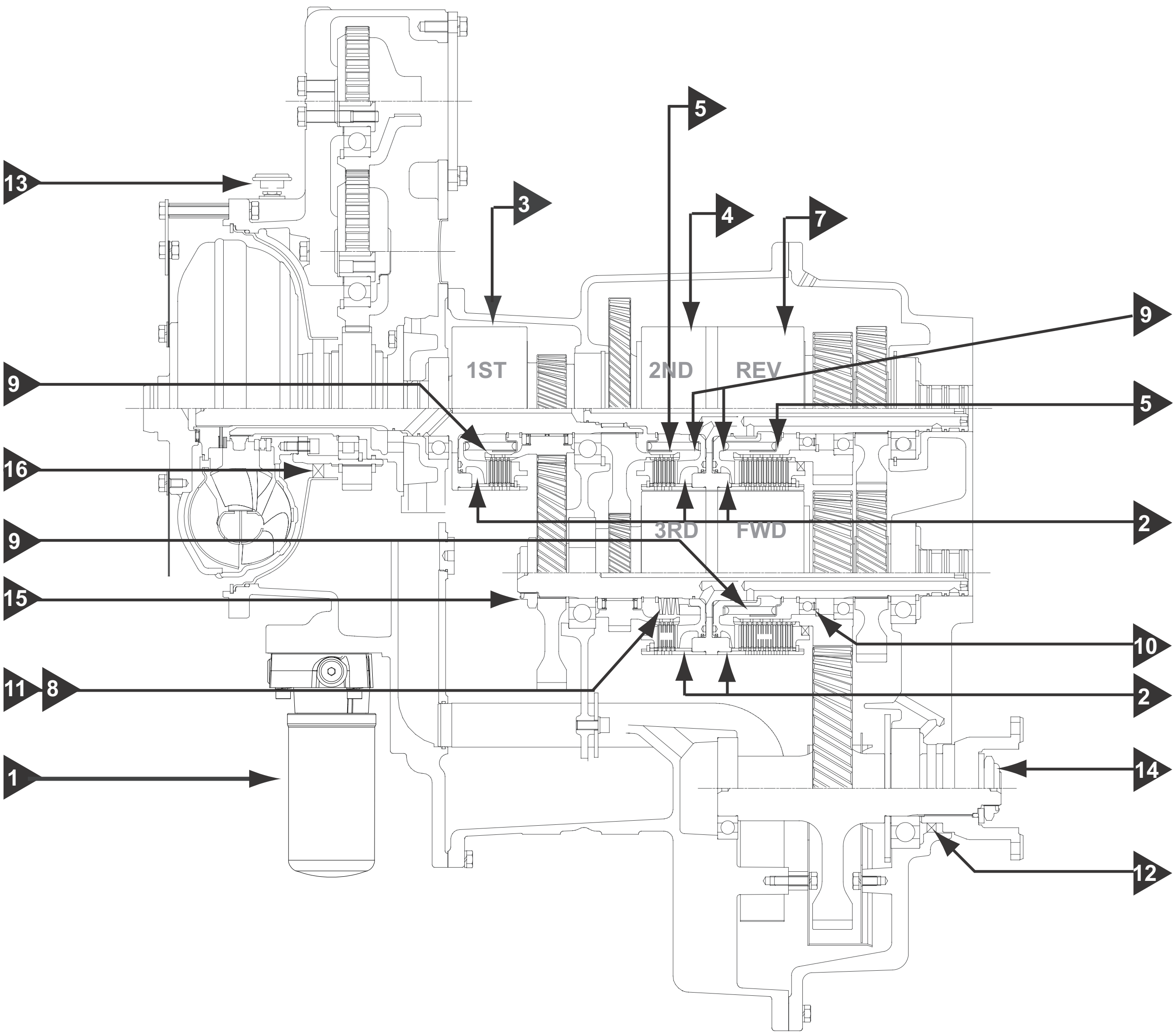
ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	NOT USED ON THIS MODEL		4	CAPSCREW	10
2	PLATE-DRIVE	5	5	LOCKWASHER	1
3	RING-BACKING	10	6	KIT-ASSY DRIVE PLATE TE17-INCL.ITEMS 2 THRU 5	1

N.S.S. = NOT SOLD SEPARATELY

N.I. = NOT ILLUSTRATED

#INSTALLATION DIAGRAMS

Transmission Assembly Instructions



- All lead in chamfers for oil seals, piston rings, and o-rings must be smooth and free from burrs. Inspect at assembly.
- Lubricate all piston ring grooves and o-rings with oil before assembly.
- Apply a thin coating of grease between seal lips on lip type seals prior to assembly.
- Use only pre-coated pipe plugs. On uncoated pipe plugs apply a light coat of Loctite 592.
- After assembly of parts using Loctite, there must not be any free or excess material which might enter the oil circuit.
- Pump must be filled up with oil prior to assembly.
- Apply a light coat of Loctite 262 or 270 to all thru hole stud holes.

1 Tighten oil filter to 22-28 lbs. ft. [30-38 N•m].

2 Teflon seals must be sized prior to assembly. Add some grease to seal diameter of clutch hub before assembly.

3 1st Clutch

TE13

4 separator plates with inner splines.
3 friction plates (friction material on both sides) with outer splines.
2 friction plates (friction material on one side) with outer splines.

TE17

5 separator plates with inner splines.
4 friction plates (friction material on both sides) with outer splines.
2 friction plates (friction material on one side) with outer splines.

Start with one side friction plate, metal against piston. Then alternate separator and friction plates. End with a one side friction plate, metal against the end plate.

Clearance:

TE13

Min clearance 1.09 mm [0.043"]

Max clearance 2.70 mm [0.106"]

TE17

Min clearance 1.63 mm [0.064"]

Max clearance 3.46 mm [0.136"]

⚠CAUTION

The friction and separator plates for FWD, REV / 1st, & 2nd / 3rd are not the same. NEVER mix plates with plates from other clutches.

4 2nd Clutch

TE13

5 separator plates with inner splines.

4 friction plates (friction material on both sides) with outer splines.

2 friction plates (friction material on one side) with outer splines.

TE17

6 separator plates with inner splines.

5 friction plates (friction material on both sides) with outer splines.

2 friction plates (friction material on one side) with outer splines.

Start with one side friction plate, metal against piston. Then alternately separator and friction plates. End with a one side friction plate, metal against the end plate.

Clearance:

TE13

Min clearance 1.63 mm [0.064"]

Max clearance 3.46 mm [0.136"]

TE17

Min clearance 1.82 mm [0.072"]

Max clearance 3.87 mm [0.152"]

⚠CAUTION

The friction and separator plates for FWD, REV / 1st, & 2nd / 3rd are not the same. NEVER mix plates with plates from other clutches.

5 3rd Clutch

TE13

4 separator plates with inner splines.

3 friction plates (friction material on both sides) with outer splines.

2 friction plates (friction material on one side) with outer splines.

TE17

4 separator plates with inner splines.

3 friction plates (friction material on both sides) with outer splines.

2 friction plates (friction material on one side) with outer splines.

Start with one side friction plate, metal against piston. Then alternately separator and friction plates. End with a one side friction plate, metal against the end plate.

Clearance:

TE13

Min clearance 1.09 mm [0.043"]

Max clearance 2.70 mm [0.106"]

TE17

Min clearance 1.09 mm [0.043"]

Max clearance 2.70 mm [0.106"]

⚠CAUTION

The friction and separator plates for FWD, REV / 1st, & 2nd / 3rd are not the same. NEVER mix plates with plates from other clutches.

6 Fwd Clutch

TE13

9 separator plates with inner splines.

9 friction plates (friction material on both sides) with outer splines.

TE17

11 separator plates with inner splines.

11 friction plates (friction material on both sides) with outer splines.

Start with one separator plate, then alternate friction and separator plates, ending with a friction plate.

Clearance:

TE13

Min clearance 1.76 mm [0.069"]

Max clearance 4.81 mm [0.189"]

TE17

Min clearance 2.99 mm [0.118"]

Max clearance 6.44 mm [0.254"]

⚠CAUTION

The friction and separator plates for FWD, REV / 1st, & 2nd / 3rd are not the same. NEVER mix plates with plates from other clutches.

7 Rev Clutch

TE13

8 separator plates with inner splines.

8 friction plates (friction material on both sides) with outer splines.

TE17

10 separator plates with inner splines.

10friction plates (friction material on both sides) with outer splines.

Start with one separator plate, then alternate friction and separator plates, ending with a friction plate.

Clearance:

TE13

Min clearance 2.29 mm [0.090"]

Max clearance 5.14 mm [0.202"]

TE17

Min clearance 3.52 mm [0.139"]

Max clearance 6.77 mm [0.267"]

⚠CAUTION

The friction and separator plates for FWD, REV / 1st, & 2nd / 3rd are not the same. NEVER mix plates with plates from other clutches.

8

⚠WARNING	
HEAVY SPRING LOAD! INSTALLATION FORCE OF DISC SPRING IS 6015Nm.	

9

⚠WARNING	
HEAVY SPRING LOAD! INSTALLATION FORCE OF COIL SPRING IS 1420 Nm.	

10 Be sure shielded and sealed bearings are mounted as shown.

11 3rd clutch spring discs concave side of fi rst spring disc is to be placed against clutch piston wear sleeve.

12 Seals must be pressed perpendicular upon shaft axis from baring side.

13 Tighten air breather to 25 - 30 lbs. ft. [34 - 41 N•m]

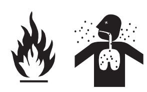
14 Tighten nut to 200 - 250 lbs. ft. [271 - 340 N•m]

15 Tighten nut to 200 - 250 lbs. ft. [271 - 340 N•m]

16 Seals must be pressed perpendicular upon shaft axis from converter side.

CLEANING AND INSPECTION

⚠ DANGER



Care should be exercised to avoid skin rashes, fire hazards, and inhalation of vapors when using solvent type and alkali cleaners.

Cleaning

Clean all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and agitated slowly until parts are thoroughly cleaned of all old lubricants and foreign materials.

Thoroughly dry all cleaned parts immediately by using moisture-free compressed air or soft lint-free absorbent wiping rags free of abrasive materials such as metal filings, contaminated oil, or lapping compound.

BEARINGS

Remove bearings from cleaning fluid and strike larger side of cone flat against a block of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. Dry bearings using moisture-free compressed air. Be careful to direct air stream across bearings to avoid spinning. DO NOT SPIN BEARINGS WHEN DRYING. Bearings may be rotated slowly by hand to facilitate the drying process.

HOUSINGS, COVERS, AND CAPS

Clean interior and exterior of housings, bearing caps, etc., thoroughly. Cast parts may be cleaned in hot solution tanks with mild alkali solutions, providing these parts do not have ground or polished surfaces. Parts should remain in solution long enough to be thoroughly cleaned and heated. This will aid the evaporation of the cleaning solution and rinse water. Parts cleaned in solution tanks must be thoroughly rinsed with clean water to remove all traces of alkali. Cast parts may also be cleaned with steam cleaner.

All parts cleaned must be thoroughly dried immediately by using moisture-free compressed air or soft lint-free absorbent wiping rags, free of abrasive materials such as metal filings, contaminated oil, or lapping compound.

Inspection

The importance of careful and thorough inspection of all parts cannot be overstressed. Replacement of all parts showing indication of wear or stress will eliminate costly and avoidable failures at a later date.

BEARINGS

Carefully inspect all rollers, cages, and cups for wear, chipping, or nicks to determine fitness of bearings for further use. DO NOT REPLACE A BEARING CONE OR CUP INDIVIDUALLY without replacing the mating cup or cone at the same time. After inspection, dip bearings in clean light oil and wrap in clean lint-free cloth or paper to protect them until installed.

OIL SEALS, GASKETS AND RETAINING RINGS

Replacement of spring loaded oil seals, gaskets, and retaining rings are more economical when the unit is disassembled than to risk premature overhaul to replace these parts at a future time. Loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing members should be handled carefully, particularly when being installed. Cutting, scratching, or curling under the lip of the seal seriously impairs its efficiency. At reassembly, lubricate rings and seals with Multipurpose Lithium Grease Grade 2 for axles and Automatic Transmission Fluid for transmissions.

GEARS AND SHAFTS

If Magna-Flux or a dye penetrant process is available, use this process to check parts. Examine teeth and the ground/polished surfaces of all gears and shafts carefully for wear, pitting, chipping, nicks, cracks, or scoring. If gear teeth are cracked or show spots where case hardening is worn through, replace with new gear. Small nicks may be removed with suitable hone stone. Inspect shafts to make certain they are not sprung, bent, or have twisted splines.

Inspection

HOUSINGS, COVERS, AND CAPS

Inspect housings, covers, and caps to be certain they are thoroughly cleaned and that mating surfaces, bearing bores, etc. are free from nicks or burrs. Check all parts carefully for evidence of cracks or conditions which can cause oil leaks or failures.

DISASSEMBLY & REASSEMBLY

Getting Started

⚠CAUTION

Cleanliness is of extreme importance in the repair and overhaul of the transmission. Before conducting repairs, the exterior of the unit must be thoroughly cleaned to prevent dirt and foreign debris from entering the transmission.

⚠CAUTION

When maintenance work requires welding, disconnect both connectors from the APC200 and from the control valve unit before any welding is started.

NOTE:

CLUTCH RETURN SPRING PACKS ARE CERTIFIED ACCORDING TO COMPRESSION WEIGHT SPECIFICATIONS AND ARE PRE-PACKED IN QUANTITIES TO REPAIR ONE (1) SPECIFIC CLUTCH.

The disc spring packs are to be used as complete assemblies and care should be taken not to intermix the individual disc springs with disc springs in another clutch or disc spring pack.

Each disc spring assembly is made up of selected springs to precisely match each part within this assembly. Failure to replace all piston return springs can result in unequal deflection within the spring pack. The result of this imbalance may adversely affect overall life of springs.

Disassembly of Transmission

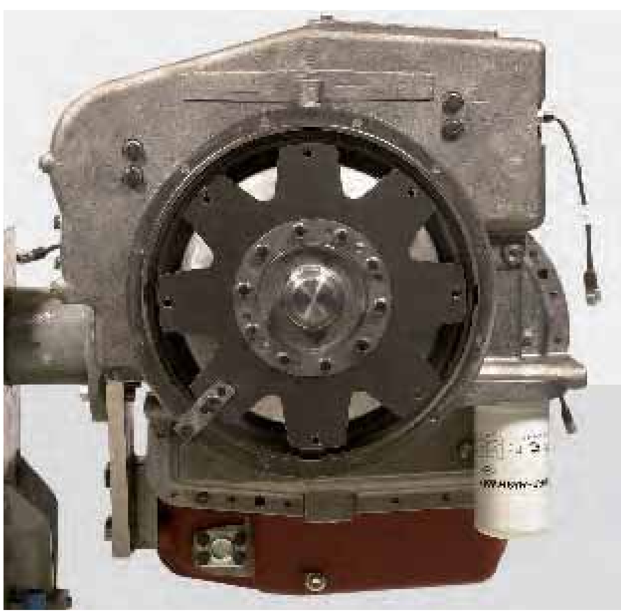


FIGURE 1: Front view of the TE17 transmission 3 speed.



FIGURE 2: Remove drive plate mounting bolts and washers.



FIGURE 3: Drive plate and backing ring removed.



FIGURE 4: Remove oil baffle retaining ring.

Disassembly of Transmission



FIGURE 5: Use special tool (see "Converter Lifting Hook", on page 159) to lift converter and oil baffle from converter housing as an assembly.



FIGURE 6: Converter housing, oil baffle and sealing ring removed.



FIGURE 7: Remove torque converter bushing.



FIGURE 8: Pry torque converter bearing from converter assembly as shown.



FIGURE 9: Torque converter gear bearing removed.



FIGURE 10: Remove torque converter capscrews and lockwashers.



FIGURE 11: Torque converter gear and gasket removed.



FIGURE 12: Oil baffle and sealing ring removed.



FIGURE 13: Remove filter element.



FIGURE 14: Remove filter adapter and gasket.



FIGURE 15: Remove charging pump cover bolts and lockwashers.



FIGURE 16: Remove charging pump cover and gasket.



FIGURE 17: Remove charging pump adaptor capscrews and lockwashers.



FIGURE 18: Remove charging pump adaptor and gasket.



FIGURE 19: Remove pump capscrews and lockwashers.



FIGURE 20: Remove pump assembly and o-ring.



FIGURE 21: Remove aux pump drive cover plate bolts and lockwashers.



FIGURE 22: Remove aux pump drive cover plate and gasket.

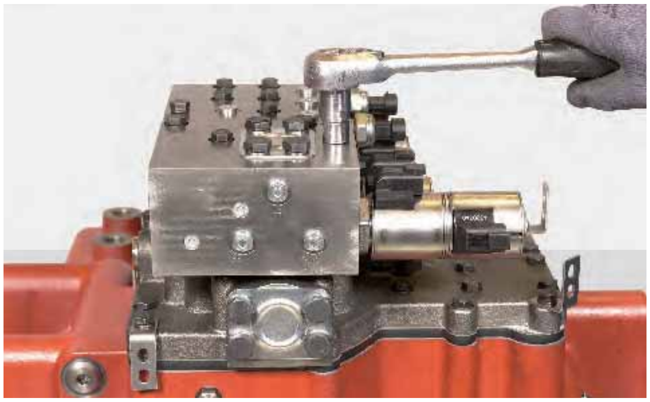


FIGURE 23: Remove control valve assembly bolts, lockwashers, and capscrews.

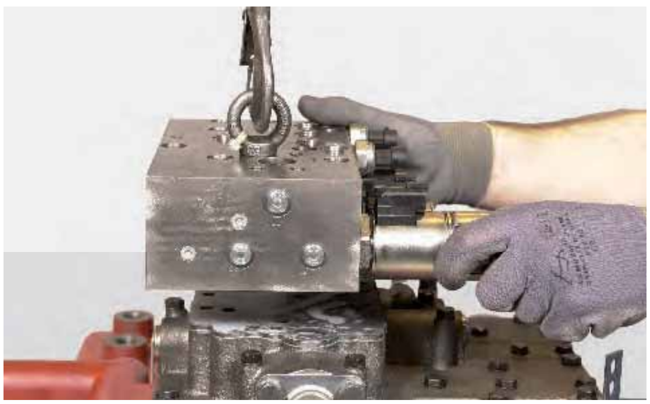


FIGURE 24: Use a chain hoist to lift valve assembly from transmission.



FIGURE 25: Remove separator plate and upper and lower gaskets.



FIGURE 26: Remove regulator valve screws and lockwashers.

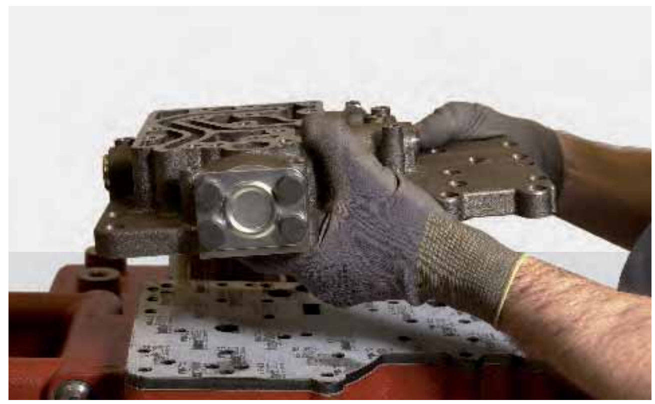


FIGURE 27: Remove regulator valve body.



FIGURE 28: Remove gaskets and separator plate.

Disassembly of Transmission



FIGURE 29: Remove rear output flange nut.



FIGURE 30: Remove flange, o-ring, washer and nut.



FIGURE 31: Remove bolts and lockwashers from rear cover.



FIGURE 32: Using external snap ring pliers, open snap ring on 2nd/REV shaft and, using a hoist, remove rear cover.



FIGURE 33: Rear cover removed.



FIGURE 34: Remove rear cover gasket.



FIGURE 35: Remove seal rings from FWD/3rd shaft.



FIGURE 36: Remove bearing retaining ring.



FIGURE 37: Use a bearing puller to remove bearing, gear, and washer.



FIGURE 38: Bearing, gear and washer removed.



FIGURE 39: Remove seal rings from 2nd/REV shaft.



FIGURE 40: Remove rear bearing retaining ring.



FIGURE 41: Remove gear, washer and bearing from 2nd/REV shaft.



FIGURE 42: Bearing washer and gear removed.



FIGURE 43: Using the special tool (see “Output Shaft Lifting Hook”, on page 162) lift the output shaft assembly from case.



FIGURE 44: Using the special tool (see “2nd/Rev Shaft Lifting Hook”, on page 163) lift 2nd/REV shaft assembly from case.



FIGURE 45: Remove oil baffle bolts and lockwashers.



FIGURE 46: Remove oil baffle.



FIGURE 47: Remove oil baffle spacers.



FIGURE 48: Remove bolt and lockwasher from lower oil baffle.



FIGURE 49: Remove lower oil baffle plate.

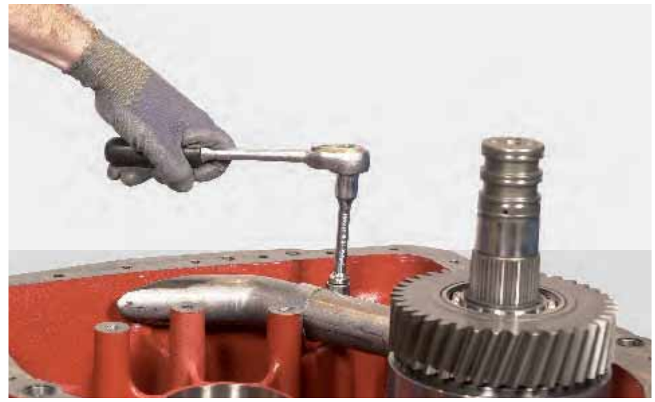


FIGURE 50: Remove suction tube bolts, clip, and spacer.



FIGURE 51: Remove suction tube.



FIGURE 52: Remove pump drive idler gear bolts and lockwashers.



FIGURE 53: Remove pump drive idler gear and bearing as an assembly.



FIGURE 54: Remove pump drive gear bolts and lockwashers.



FIGURE 55: Remove pump drive gear and bearing as an assembly.



FIGURE 56: Remove pump drive gear bolts and lockwashers.



FIGURE 57: Remove pump drive gear and bearing as an assembly.



FIGURE 58: Remove pump drive gear bolts and lockwashers.



FIGURE 59: Remove pump drive gear and bearing as an assembly.



FIGURE 60: Remove stator support bolts and lockwashers.



FIGURE 61: Stator support and gasket removed.



FIGURE 62: Remove converter housing to transmission case bolts and washers.

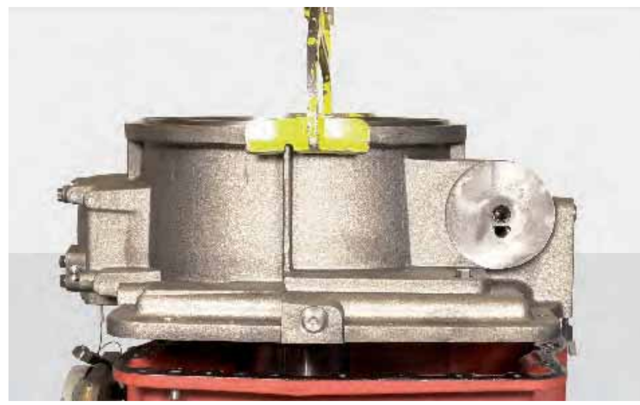


FIGURE 63: Remove converter housing with a special tool (see “Case Lifting Hook”, on page 160) from transmission case.



FIGURE 64: Remove lock nut from forward and 3rd shaft assembly.


FIGURE 65: Fit special tool (see "Drum Holder", on page 158) to prevent gear from dropping when transmission is turned.


FIGURE 66: Remove 2nd gear retaining ring.


FIGURE 67: Pull up 2nd gear slightly to allow FWD/3rd clutch drum and shaft assembly to be removed.


FIGURE 68: Remove 2nd gear from transmission case.


FIGURE 69: Remove special tool.


FIGURE 70: Remove 1st clutch drum and turbine shaft as an assembly.



FIGURE 71: Remove gear.



FIGURE 72: Remove 1st clutch drum retaining ring.

Disassembly & reassembly of rear cover



FIGURE 73: Remove rear oil baffle bolts and lockwashers.

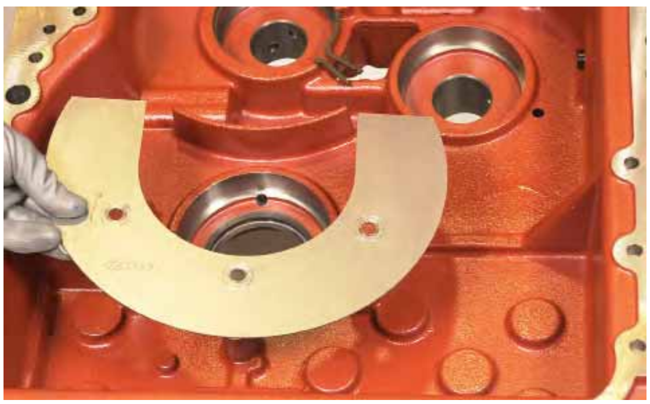


FIGURE 74: Remove rear oil baffle.



FIGURE 75: Install rear oil baffle.



FIGURE 76: Install oil baffle and lockwashers and tighten to specified torque.



FIGURE 77: Remove snap ring REV clutch.



FIGURE 78: Install snap ring REV clutch.

Disassembly of 1st clutch drum and turbine shaft



FIGURE 79: Using a bearing puller to remove bearing needle out shaft.



FIGURE 80: Use a bearing puller to remove bearing from shaft.



FIGURE 81: Remove snap ring.



FIGURE 82: Remove upper thrust bearing washer.



FIGURE 83: Remove clutch gear.



FIGURE 84: Remove needle bearings and spacer.

Disassembly of 1st clutch drum and turbine shaft



FIGURE 85: Remove lower thrust bearing.



FIGURE 86: Remove end plate retaining ring.

⚠CAUTION

Do not bend or disform teeth.



FIGURE 87: Remove clutch disc end plate.



FIGURE 88: Remove 1 (one) outer half disc.



FIGURE 89: Remove inner and outer clutch discs.



FIGURE 90: Remove 1 (one) outer half disc.



FIGURE 91: Using a bearing puller to remove lower thrust washer.



FIGURE 92: Remove retaining ring.



FIGURE 93: Compress piston return spring and remove spring retainer snap ring.



FIGURE 94: Remove spring retainer and spring.



FIGURE 95: Remove return spring spacer.



FIGURE 96: Remove clutch piston assembly.

Disassembly of 1st clutch drum and turbine shaft



FIGURE 97: Remove inner piston ring from shaft.



FIGURE 98: Remove upper sealing ring from turbine shaft.



FIGURE 99: Remove lower sealing ring from turbine shaft.



FIGURE 100: Use a bearing puller to remove bearing from shaft.

Reassembly of 1st clutch drum and turbine shaft



FIGURE 101: Warm bearing to 248 F° [120 C°] and install on shaft.



FIGURE 102: Install lower seal ring on shaft.



FIGURE 103: Install upper seal ring on shaft.



FIGURE 104: Install piston inner seal on shaft.



FIGURE 105: See “Cleaning and Inspection”, on page 91. Install clutch piston outer seal and install piston in clutch drum.

NOTE:

Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating piston while holding a round object against the new sealing ring. Rotate piston until seal is flush with outer diameter of piston.



FIGURE 106: Install return spring spacer.

Reassembly of 1st clutch drum and turbine shaft



FIGURE 107: Install piston spring and spring retainer.



FIGURE 108: Compress return spring and install snap ring.



FIGURE 109: Install retaining ring.



FIGURE 110: Install one outer half disc with friction material away from piston.



FIGURE 111: Install one steel disc. Alternate friction and steel discs until proper amount of discs are installed. First and last disc are steel.



FIGURE 112: Install one outer half disc with friction material down.



FIGURE 113: Install end plate.



FIGURE 114: Install end plate retaining ring.



FIGURE 115: Warm lower thrust washer to 248 F° [120 C°] and install thrust washer.



FIGURE 116: Install inner thrust bearing.



FIGURE 117: Install needle bearings and spacer.



FIGURE 118: Install 1st clutch gear in clutch drum. Align splines on clutch gear with internal teeth of steel discs.

NOTE:

Do not force this operation. Gear splines must be in full position with internal teeth of all inner discs.

Reassembly of 1st clutch drum and turbine shaft



FIGURE 119: Install outer thrust bearing and spacers.



FIGURE 120: Install outer thrust bearing retaining snap ring.



FIGURE 121: Warm bearing to 248 F° [120 C°] and install bearing on shaft.



FIGURE 122: Install bearing needle in shaft.

Disassembly of REV clutch drum



FIGURE 123: Remove outer bearing snap ring



FIGURE 124: Use a bearing puller to remove gear and bearing.



FIGURE 125: Clutch gear and bearing removed.



FIGURE 126: Remove end plate retaining ring.



FIGURE 127: Remove end plate and seal as assembly.



FIGURE 128: Remove inner and outer discs.

Disassembly of REV clutch drum



FIGURE 129: Use a bearing puller to remove clutch inner bearing.



FIGURE 130: Inner bearing removed.



FIGURE 131: Remove inner bearing snap ring.



FIGURE 132: Compress spring to remove spring retainer snap ring.



FIGURE 133: Remove spring and spring retainer.



FIGURE 134: Remove return spring spacer.



FIGURE 135: Remove clutch piston assembly.



FIGURE 136: Remove clutch piston inner seal.

Disassembly of 2nd clutch drum



FIGURE 137: Remove end plate retainer ring.



FIGURE 138: Remove end plate.



FIGURE 139: Remove one outer half disc.



FIGURE 140: Remove inner and outer discs.



FIGURE 141: Remove one outer half disc.



FIGURE 142: Compress spring and remove spring retainer snap ring.



FIGURE 143: Remove Belleville spring (5) assembly and make sure to keep them in the same position.



FIGURE 144: Remove clutch piston spring spacer.



FIGURE 145: Remove clutch piston assembly.



FIGURE 146: Remove inner piston ring.



FIGURE 147: Remove clutch shaft sealing ring.



FIGURE 148: Use a bearing puller to remove bushing from clutch shaft.

Reassembly of 2nd clutch drum



FIGURE 149: Warming up to 248 F° [120 C°] install bushing on shaft.



FIGURE 150: Install clutch shaft sealing ring.



FIGURE 151: Install inner piston sealing ring.



FIGURE 152: See "Cleaning and Inspection", on page 91. Install clutch piston outer sealing ring and size as explained.

NOTE:

Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating piston while holding a round object against the new sealing ring. Rotate piston until seal is flush with outer diameter of piston.



FIGURE 153: Install spacer clutch piston spring.



FIGURE 154: Install Belleville spring (5) assembly.



FIGURE 155: Compress return spring and install snap ring.



FIGURE 156: Install one outer half disc with friction material away from piston.



FIGURE 157: Install one steel disc. Alternate friction and steel discs until proper amount of discs are installed.
First and last discs are steel.



FIGURE 158: Install one outer half disc with friction material down.



FIGURE 159: Install end plate.



FIGURE 160: Install end plate retaining ring.

Reassembly of REV clutch drum



FIGURE 161: Install piston inner seal on shaft.



FIGURE 162: See "Cleaning and Inspection", on page 91. Install clutch piston outer seal ring and size as explained.

NOTE:

Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating piston while holding a round object against the new sealing ring. Rotate piston until seal is flush with outer diameter of piston.



FIGURE 163: Install clutch piston spring spacer.



FIGURE 164: Install piston spring and spring retainer.



FIGURE 165: Compress return spring and install snap ring.



FIGURE 166: Install one steel disc. Alternate friction and steel discs until proprer amount are installed. First and last discs are steel.



FIGURE 167: Install new seal into backing plate and install plate.



FIGURE 168: Install backing plate retaining ring.



FIGURE 169: Install inner bearing retaining ring.



FIGURE 170: Install reverse clutch gear with inner and outer bearing in clutch drum. Warm the clutch gear up to 248 F° [120 C°] and align the splines on clutch gear with internal teeth of steel discs. DO NOT FORCE THIS OPERATION.
Gear splines must be in full position with internal teeth of all inner discs.



FIGURE 171: Install outer bearing snap ring.

Disassembly of 3rd clutch drum



FIGURE 172: Remove 3rd shaft front bearing snap ring.



FIGURE 173: Remove 3rd shaft front bearing.



FIGURE 174: Remove thrust bearing snap ring.



FIGURE 175: Remove thrust bearing and spacer.



FIGURE 176: Remove 3rd clutch gear.



FIGURE 177: Remove 3rd clutch gear needle bearing.



FIGURE 178: Remove inner thrust bearing.



FIGURE 179: Use a bearing puller to remove thrust bearing spacer.



FIGURE 180: Remove thrust bearing snap ring.



FIGURE 181: Remove end plate retaining ring.



FIGURE 182: Remove end plate.



FIGURE 183: Remove half disc with friction material down to inner disc.

Disassembly of 3rd clutch drum



FIGURE 184: Remove inner and outer disc.



FIGURE 185: Remove half disc with friction material up.



FIGURE 186: Compress spring and remove snap ring.



FIGURE 187: Remove Belleville spring (5) assembly and make sure to keep them in the same position.



FIGURE 188: Remove clutch piston spring spacer.



FIGURE 190: Remove clutch piston assembly.



FIGURE 191: Remove inner piston ring.

Disassembly of FWD clutch drum



FIGURE 192: Remove outer bearing snap ring.



FIGURE 193: Use a bearing puller to remove gear and bearing.



FIGURE 194: Clutch gear and bearing removed.



FIGURE 195: Remove end plate retaining ring.



FIGURE 196: Remove end plate and seal as an assembly.



FIGURE 197: Remove inner and outer discs.



FIGURE 198: Use a bearing puller to remove clutch inner bearing.



FIGURE 199: Remove inner bearing snap ring



FIGURE 200: Compress spring and remove spring retainer snap ring.



FIGURE 201: Spring and spring retainer removed.



FIGURE 202: Remove clutch piston spring spacer.



FIGURE 203: Remove clutch piston assembly.

Disassembly of FWD clutch drum



FIGURE 204: Remove clutch piston inner seal.

Reassembly of FWD clutch drum



FIGURE 205: Install piston inner seal.



FIGURE 206: See “Cleaning and Inspection”, on page 91.
Install clutch piston outer seal ring and size as explained.

NOTE:

Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating piston while holding a round object against the new sealing ring. Rotate piston until seal is flush with outer diameter of piston.



FIGURE 207: Install clutch piston spring spacer.



FIGURE 208: Install piston return spring and spring retainer.



FIGURE 209: Compress spring and spring retainer. Install retainer snap ring.
Be sure snap ring is in full position in groove.



FIGURE 210: Install inner bearing snap ring.

Reassembly of FWD clutch drum



FIGURE 211: Install one steel disc. Alternate friction and steel discs until the corect amount of discs are installed. First and last discs are steel.



FIGURE 212: Install new seal into end plate and install end plate.



FIGURE 213: Install end plate retaining ring.



FIGURE 214: Install FWD clutch gear with inner and outer bearing in clutch drum. Warm the clutch gear up to 248 F° [120 C°] and align the splines on clutch gear with internal splines of steel discs. DO NOT FORCE THIS OPERATION.
Gear splines must be in full position with internal teeth of all inner discs.



FIGURE 215: Install outer bearing retaining ring.

Reassembly of 3rd clutch drum



FIGURE 216: Install new inner piston sealing ring.



FIGURE 217: See "Cleaning and Inspection", on page 91.
Install clutch piston outer seal.
Seal must be sized.

NOTE:

Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating piston while holding a round object against the new sealing ring. Rotate piston until seal is flush with outer diameter of piston.



FIGURE 218: Install clutch piston spring spacer.



FIGURE 219: Install Belleville spring (5) assembly.



FIGURE 220: Compress spring and install clutch piston spring retainer snap ring. Be sure ring is in full position in groove.



FIGURE 221: Install one outer half disc with friction material away from piston.

Reassembly of 3rd clutch drum



FIGURE 222: Install one steel disc. Alternate friction and steel discs until proper amount of discs are installed.
First and last disc are steel.



FIGURE 223: Install one outer half disc with friction material down.



FIGURE 224: Install end plate.



FIGURE 225: Install end plate retaining ring.



FIGURE 226: Install thrust bearing snap ring.



FIGURE 227: Warm thrust washer to 248 F° [120 C°] and install thrust washer.



FIGURE 228: Install thrust bearing.



FIGURE 229: Install needle bearing.



FIGURE 230: Install 3rd clutch gear in clutch drum. Align splines on clutch gear with internal teeth of steel discs.
DO NOT FORCE THIS OPERATION.
Gear splines must be in full position with internal teeth of all inner discs.



FIGURE 231: Install outer thrust bearing and thrust washer.



FIGURE 232: Install outer thrust bearing retaining snap ring



FIGURE 233: Warm bearing up to 248 F° [120 C°] and install bearing.

Reassembly of 3rd clutch drum



FIGURE 234: Install bearing retaining ring.

Disassembly of output shaft



FIGURE 235: Use a bearing puller as shown to remove speed sensor gear, bearing, and spacer.
Be careful not to damage teeth on speed sensor gear.



FIGURE 236: Gear, bearing and spacer removed.



FIGURE 237: Use a bearing puller and remove bearing.

Reassembly of output shaft



FIGURE 238: Warm bearing to 248 F° [120 C°] and install bearing.



FIGURE 239: Turn shaft and install speed sensor gear.



FIGURE 240: Install spacer.



FIGURE 241: Warm bearing to 248 F° [120 C°] and install bearing.

Disassembly of pump drive



FIGURE 242: Remove pump drive snap ring.



FIGURE 243: Remove bearing and support.

Reassembly of pump drive



FIGURE 244: Install bearing and support in gear.



FIGURE 245: Install snap ring.

Reassembly of transmission



FIGURE 246: Install new oil seal.



FIGURE 247: Install new oil seal in baffle with special tool PN ASO TE 1700300 (see “Oil Baffle Seal Driver”, on page 161).



FIGURE 248: Install oil seal baffle and new o-ring on torque converter.



FIGURE 249: Install new gasket.



FIGURE 250: Install torque converter gear.



FIGURE 251: Install torque converter gear capscrews and lockwashers and tighten to specified torque.



FIGURE 252: Install torque converter bearing.



FIGURE 253: Install torque converter bushing.



FIGURE 254: Install input shaft rear bearing retaining snap ring.



FIGURE 255: Install turbine shaft and 1st clutch as an assembly.



FIGURE 256: Install FWD and 3rd shaft gear.



FIGURE 257: Fit special tool to prevent gear from dropping when transmission is turned.
See “Drum Holder”, on page 158.



FIGURE 258: Install oil baffle plate mounting spacers. (Longest in the middle).



FIGURE 259: Install oil baffle using Loctite 243 on bolts and tighten to specified torque.



FIGURE 260: Install 2nd clutch gear.



FIGURE 261: Raise 2nd gear up to allow 3rd/FWD shaft assembly to be installed.



FIGURE 262: Install 2nd clutch gear retaining ring.



FIGURE 263: Remove special tool.



FIGURE 264: Install gear retaining nut.

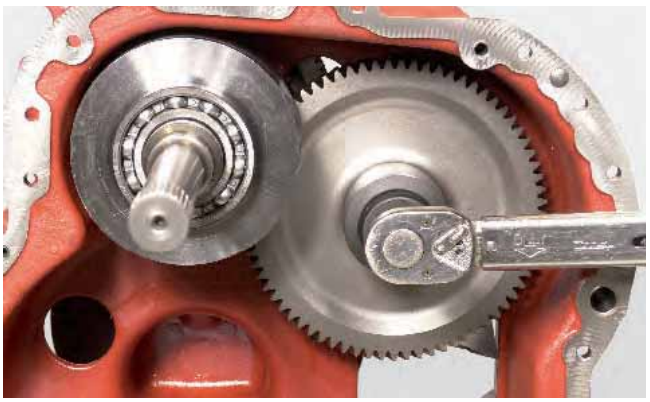


FIGURE 265: Block gears from turning and tighten to specified torque.



FIGURE 266: Install new converter housing gasket and o-ring.

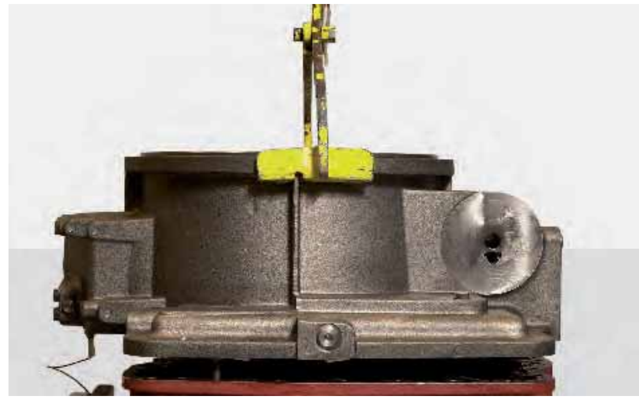


FIGURE 267: Using aligning studs, install converter housing on transmission case.



FIGURE 268: Tap down dowel pins into converter housing and transmission case.



FIGURE 269: Install bolts and lockwashers. Tighten to specified torque.



FIGURE 270: Install 2nd/REV clutch assembly.
Align splines on clutch gear with internal teeth of steel discs.
DO NOT FORCE THIS OPERATION.
Gear splines must be in full position with internal teeth of all inner discs.



FIGURE 271: Install output shaft gear assembly.



FIGURE 272: Warm gear (44T) to 266 F° [130 C°] and install on 2nd/REV clutch shaft.



FIGURE 273: Install bearing spacer.



FIGURE 274: Warm bearing to 248 F° [120 C°] and install bearing with snap ring groove down.



FIGURE 275: Install bearing retaining snap ring.



FIGURE 276: Install clutch shaft sealing rings.



FIGURE 277: Warm gear (48T) to 266 F° [130 C°] and install on 3rd/FWD clutch shaft.



FIGURE 278: Install bearing spacer.



FIGURE 279: Warm bearing to 248 F° [120 C°] and install bearing.



FIGURE 280: Install bearing retaining snap ring.



FIGURE 281: Install clutch shaft sealing rings.



FIGURE 282: Install suction tube using Loctite 243 on bolts and tighten up to specified torque.



FIGURE 283: Install clip spacer washer and bolt using Loctite 243.



FIGURE 284: Install 2 suction tube bolts using Loctite 243 and tighten to specified torque.



FIGURE 285: Install new gasket and clutch pressure (5) o-rings into o-ring grooves.



FIGURE 286: Use two guide studs to assist the fitting of the rear cover.



FIGURE 287: Use spreading type snap ring pliers, spread ears on 2nd/REV shaft rear bearing retaining snap ring. Holding snap ring open, tap transmission case into place.

Reassembly of transmission



FIGURE 288: Tap dowel pins into rear cover and transmission case.

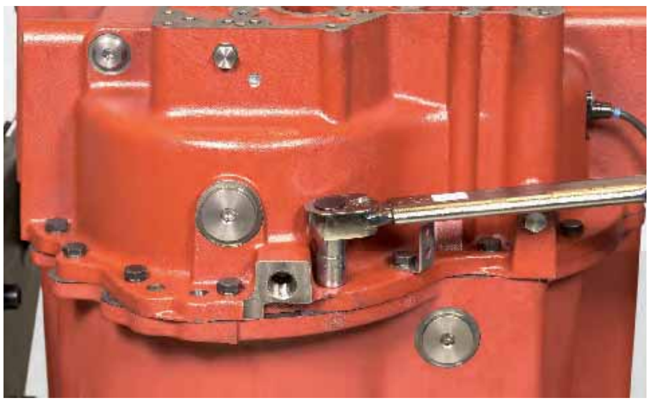


FIGURE 289: Install rear cover to transmission case bolts and lockwashers. Torque to specified torque.



FIGURE 290: Pull Rev/2nd shaft to secure snap ring.



FIGURE 291: Install output flange.



FIGURE 292: Install o-ring, washer, and nut.



FIGURE 293: Tighten nut to 250 - 300 lbs. ft. [339-407 N•m].



FIGURE 294: Install new control valve inner gasket.



FIGURE 295: Install separator plate.



FIGURE 296: Install new control valve outer gasket.



FIGURE 297: Use two (2) aligning studs and install control valve assembly.



FIGURE 298: Install bolts and lockwashers.

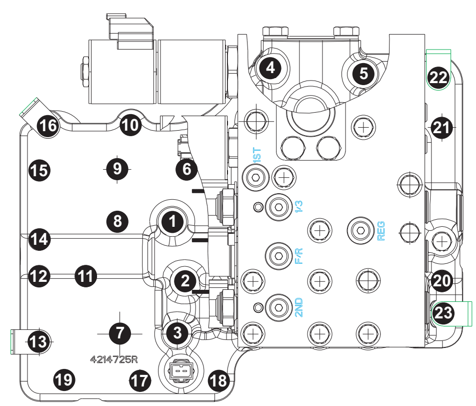


FIGURE 299: Tighten to specified torque in sequence shown above.

Reassembly of transmission



FIGURE 300: Install separator plate with a new gasket on each side.



FIGURE 301: Use a chain hoist to position valve assembly on transmission.

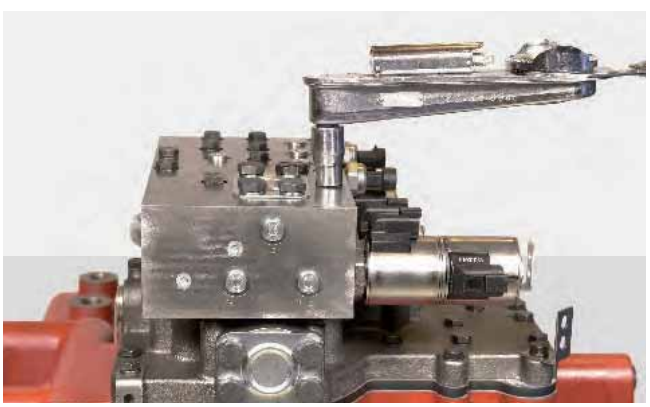


FIGURE 302: Install control valve assembly bolts, lockwashers, and capscrews. Tighten to specified torque.

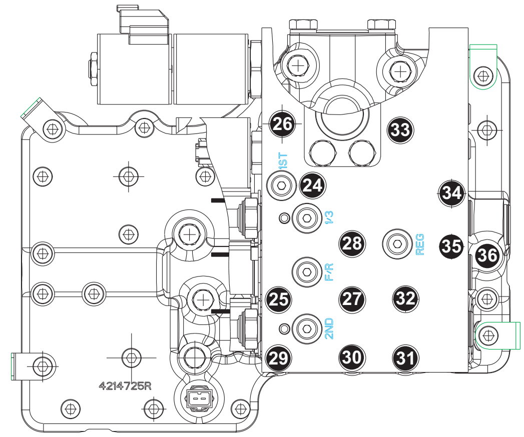


FIGURE 303: Tighten to specified torque in sequence shown above.



FIGURE 304: Install new stator support gasket.



FIGURE 305: Install new sealing ring on stator support and install stator support.



FIGURE 306: Install stator support bolts and lockwashers. Tighten to specified torque.



FIGURE 307: Install pump drive (x2).



FIGURE 308: Install idler gear, washer, and bearing as an assembly.



FIGURE 309: Install idler gear bolts and lockwashers. Tighten to specified torque.



FIGURE 310: Install pump driver cover and gasket.



FIGURE 311: Install bolts and lockwasher. Tighten to specified torque.

Reassembly of transmission

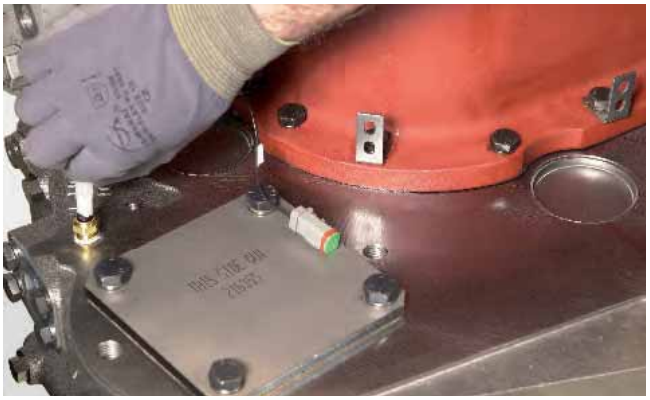


FIGURE 312: Install temperature sensor.

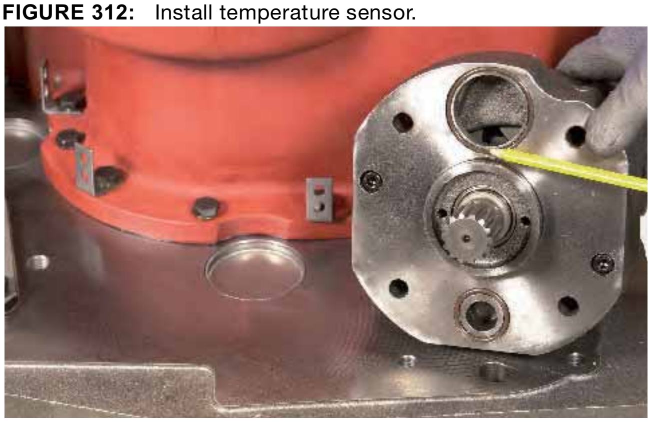


FIGURE 313: Install charging pump and new o-ring.



FIGURE 314: Install charging pump capscrews. Tighten to specified torque.



FIGURE 315: Install adaptor plate and new gasket.



FIGURE 316: Install adaptor plate capscrews and tighten to specified torque.

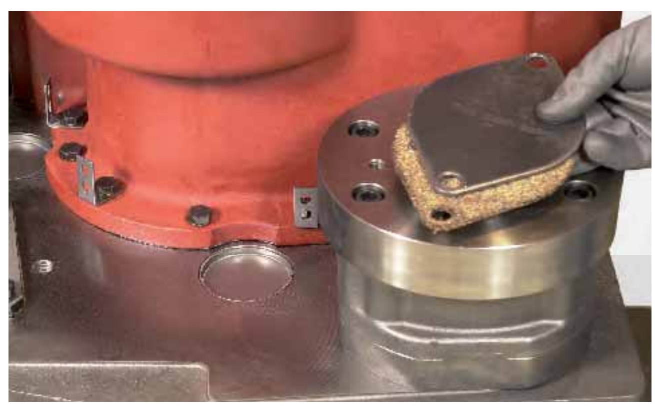


FIGURE 317: Install adaptor plate cover and new gasket.

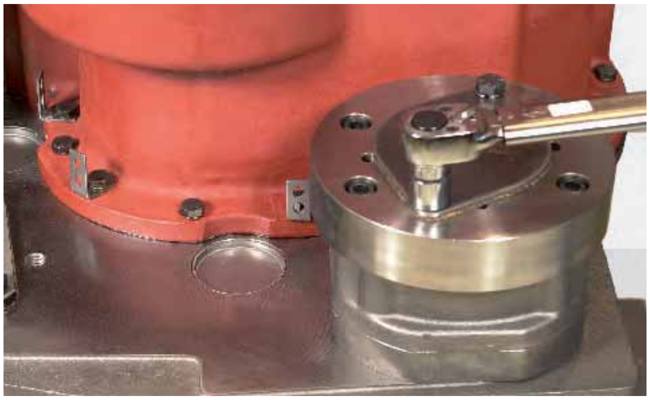


FIGURE 318: Install adaptor plate cover bolts and lockwashers. Tighten to specified torque.



FIGURE 319: Install filter adaptor and new gasket.



FIGURE 320: Install filter adaptor with Loctite 243. Tighten to specified torque using special tool ASO TE 8003100 (see "Filter Adaptor Tool", on page 164).



FIGURE 321: Install oil filter and tighten to 22-28 lbs ft. [30-38 N·m].



FIGURE 322: See "Cleaning and Inspection", on page 91. After installing new seal ring on baffle plate, use a special tool (see "Converter Lifting Hook", on page 159) and install converter assembly in housing.



FIGURE 323: Install oil baffle retaining ring.

Reassembly of transmission



FIGURE 324: Install drive plate and backing ring.



FIGURE 325: Install drive plate bolts and lockwashers. Tighten to specified torque.



FIGURE 326: Install speed sensor in converter housing and transmission case.

NOTE:

The other end of the speed sensor has to be connected to the transmission to function.

TORQUE SPECIFICATIONS

Lubricated or Plated Screws

COARSE PITCH

SIZE OF BOLT	TYPE OF BOLT			
	Grade 5		Grade 8	
	lbs. ft.	N•m	lbs. ft.	N•m
.2500	8 - 10	10.8 - 13.6	9 - 11	12.2 - 14.9
.3125	12 - 16	16.3 - 21.7	26 - 30	35.2 - 40.7
.3750	23 - 25	31.2 - 33.9	33 - 36	44.7 - 48.8
.4375	37 - 41	50.2 - 55.6	52 - 57	70.5 - 77.3
.5000	57 - 63	77 - 85	80 - 88	108 - 119
.5625	82 - 90	111 - 122	115 - 127	156 - 172
.6250	113 - 124	153 - 168	159 - 175	216 - 237
.7500	200 - 220	271 - 298	282 - 310	382 - 420

FINE PITCH

SIZE OF BOLT	TYPE OF BOLT			
	Grade 5		Grade 8	
	lbs. ft.	N•m	lbs. ft.	N•m
.2500	9 - 11	12.2 - 14.9	11 - 13	14.9 - 17.6
.3125	16 - 20	21.7 - 27.1	28 - 32	38.0 - 43.4
.3750	26 - 29	35.2 - 39.3	37 - 41	50.2 - 55.6
.4375	41 - 45	56 - 61	58 - 64	79 - 87
.5000	64 - 70	87 - 95	90 - 99	122 - 134
.5625	91 - 100	123 - 136	128 - 141	174 - 191
.6250	129 - 141	174 - 191	180 - 198	224 - 268
.7500	223 - 245	302 - 332	315 - 347	427 - 470

Lubricated or Plated Screws

COARSE PITCH

SIZE OF BOLT	TYPE OF BOLT					
	Grade 8.8		Grade 10.9		Grade 12.9	
	lbs. ft.	N•m	lbs. ft.	N•m	lbs. ft.	N•m
M5 x 0.8	3.7 - 4.4	5 - 6	5.2 - 5.9	7 - 8	5.9 - 7.4	8 - 10
M6 x 1	5.9 - 7.4	8 - 10	8.9 - 11.1	12 - 15	9.6 - 11.8	13 - 16
M8 x 1.25	14.8 - 18.4	20 - 25	22.1 - 25.8	30 - 35	25.8 - 29.5	35 - 40
M10 x 1.5	29.5 - 36.9	40 - 50	44.3 - 47.9	60 - 65	47.9 - 55.3	65 - 75
M12 x 1.75	50 - 55	68 - 75	74 - 81	100 - 110	85 - 96	115 - 130
M14 x 2	81 - 92	110 - 125	111 - 129	150 - 175	133 - 155	180 - 210
M16 x 2	125 - 140	170 - 190	177 - 203	240 - 275	207 - 236	280 - 320
M20 x 2.5	236 - 266	320 - 360	332 - 369	450 - 500	387 - 443	525 - 600
M24 x 3	420 - 479	570 - 650	590 - 664	800 - 900	664 - 774	900 - 1050
M30 x 3.5	848 - 959	1150 - 1300	1180 - 1328	1600 - 1800	1364 - 1549	1850 - 2100
M36 x 4	1475 - 1660	2000 - 2250	2028 - 2323	2749 - 3149	2397 - 2729	3249 - 3699

FINE PITCH

SIZE OF BOLT	TYPE OF BOLT					
	Grade 8.8		Grade 10.9		Grade 12.9	
	lbs. ft.	N•m	lbs. ft.	N•m	lbs. ft.	N•m
M8 x 1	17 - 20	23 - 28	25 - 28	34 - 39	30 - 34	41 - 46
M10 X 1	35 - 42	47 - 57	52 - 60	71 - 81	62 - 69	84 - 94
M10 x 1,25	32 - 40	44 - 54	49 - 57	67 - 77	58 - 66	79 - 89
M12 x 1,25	60 - 68	82 - 92	89 - 96	120 - 130	105 - 116	143 - 158
M12 x 1,5	58 - 65	78 - 88	86 - 94	117 - 127	101 - 112	138 - 153
M14 x 1,5	94 - 105	128 - 143	142 - 153	193 - 208	162 - 184	220 - 250
M16 x 1,5	159 - 169	215 - 228	216 - 227	293 - 308	258 - 273	350 - 370
M18 x 1,5	221 - 236	300 - 320	319 - 330	433 - 448	369 - 398	500 - 540
M18 x 2	207 - 221	280 - 300	304 - 315	413 - 428	347 - 376	470 - 510
M20 x 1,5	302 - 332	410 - 450	439 - 476	595 - 645	503 - 559	683 - 758
M22 x 1,5	413 - 443	560 - 600	586 - 623	795 - 845	681 - 736	923 - 998
M24 x 1,5	531 - 590	720 - 800	767 - 841	1040 - 1140	882 - 992	1195 - 1345
M24 x 2	509 - 568	690 - 770	730 - 804	990 - 1090	845 - 955	1145 - 1295
M27 x 1,5	789 - 848	1070 - 1150	1129 - 1202	1530 - 1630	1308 - 1420	1175 - 1925

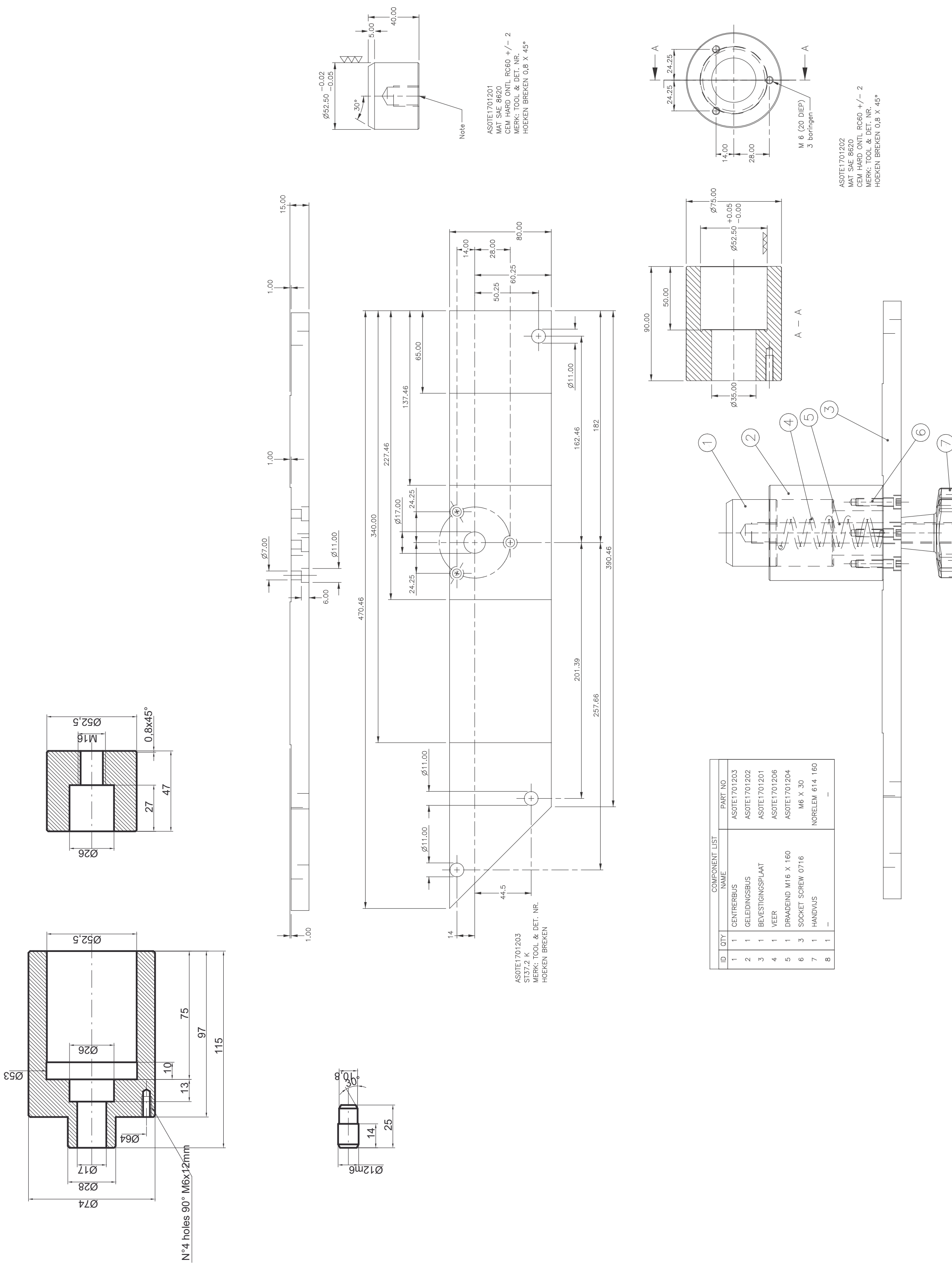
Pipe Plugs

THREAD SIZE	lbs. ft.	N•m
M10 x 1	6 - 7	8 - 10
M14 x 1.5	7 - 9	10 - 12
M18 x 1.5	25 - 30	34 - 41
M22 x 1.5	35 - 44	48 - 60
M26 x 1.5	45 - 50	61 - 68
M33 x 2	83 - 103	112 - 140

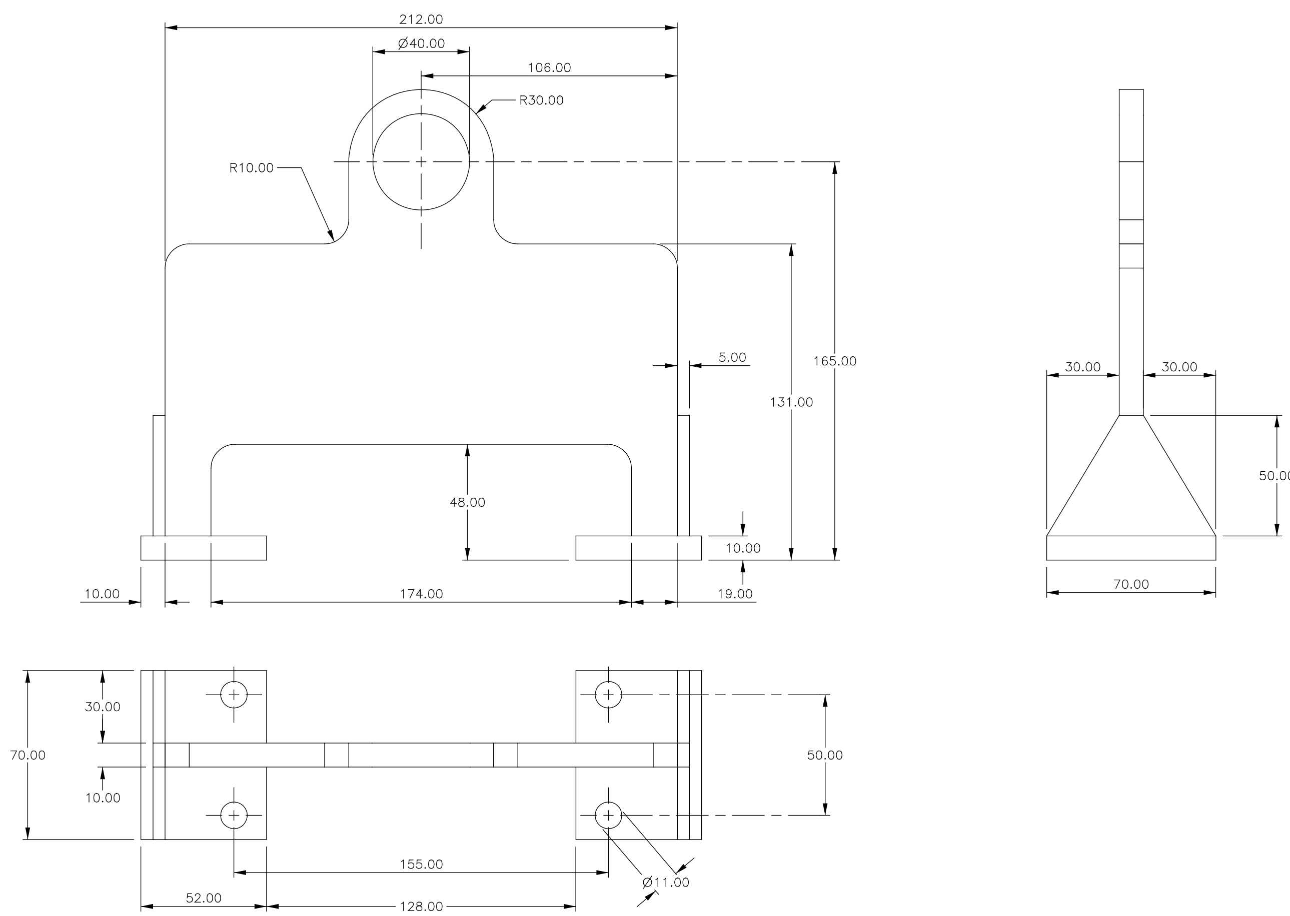
THREAD SIZE	lbs. ft.	N•m
1/16 - 27	5 - 7	7 - 9
1/8 - 27	7 - 10	9 - 14
1/4 - 18	15 -20	20 - 27
5/16 - 24	3 - 5	4 - 7
3/8 - 24	5 - 8	7 - 11
3/8 - 18	25 - 30	34 - 41
1/2 - 14	30 - 35	41 - 47
1/2 - 20	10 - 13	14 - 18
3/4 - 10	40 - 45	54 - 61
3/4 - 14	40 - 45	54 - 61
7/16 - 20	7 - 10	9 - 14
9/16 - 18	12 - 15	16 - 20
3/4 - 16	20 - 25	27 - 34
7/8 - 14	30 - 35	41 - 47
11/16 - 12	45 - 50	61 - 68
15/16 - 12	65 - 75	88 - 102
1 - 11-1/2	50 - 55	68 - 75
1-1/4 - 11-1/2	60 - 65	81 - 88
1-5/8 - 12	75 - 85	102 - 115
1-7/8 - 12	75 - 85	102 - 115

SPECIAL TOOLS

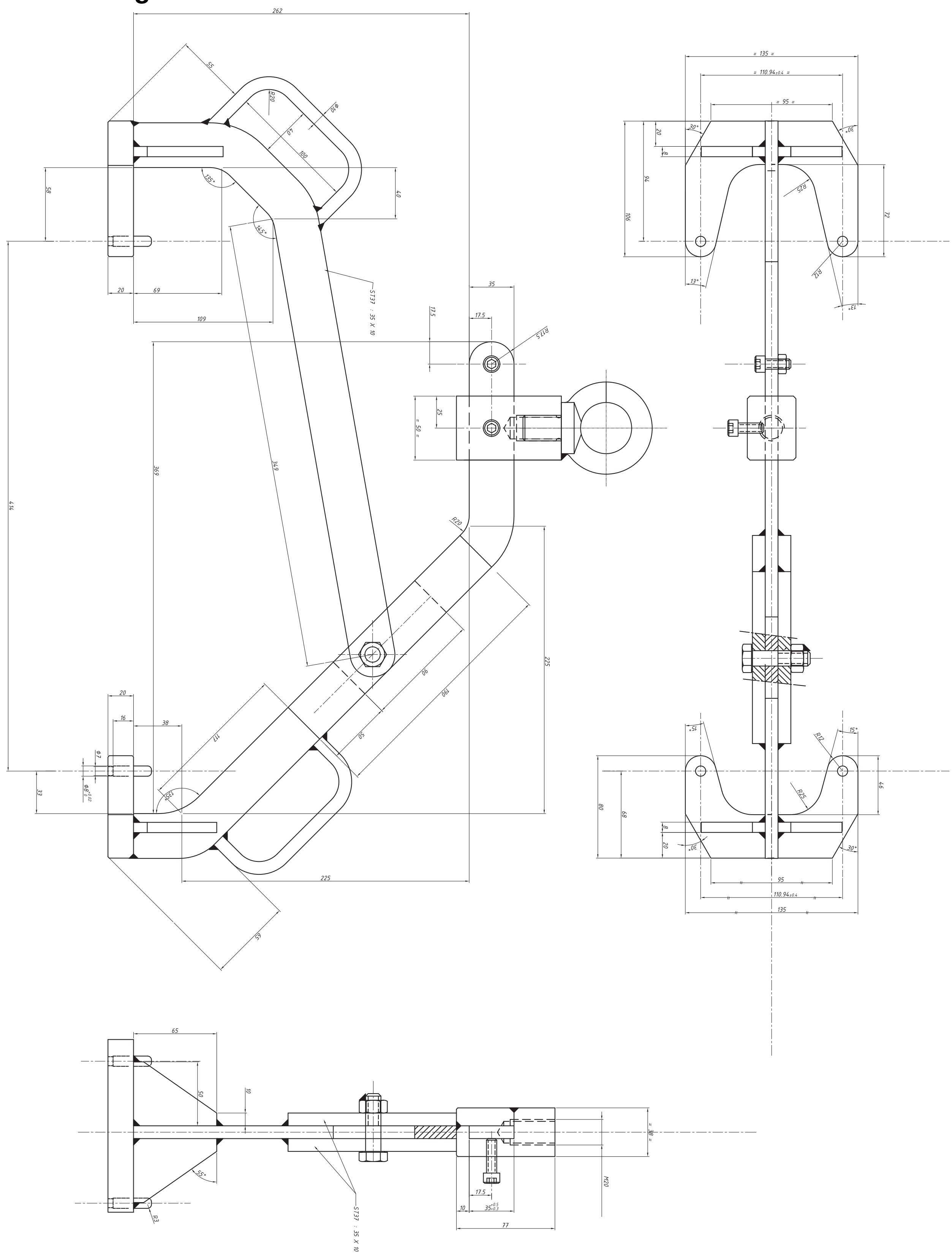
Drum Holder



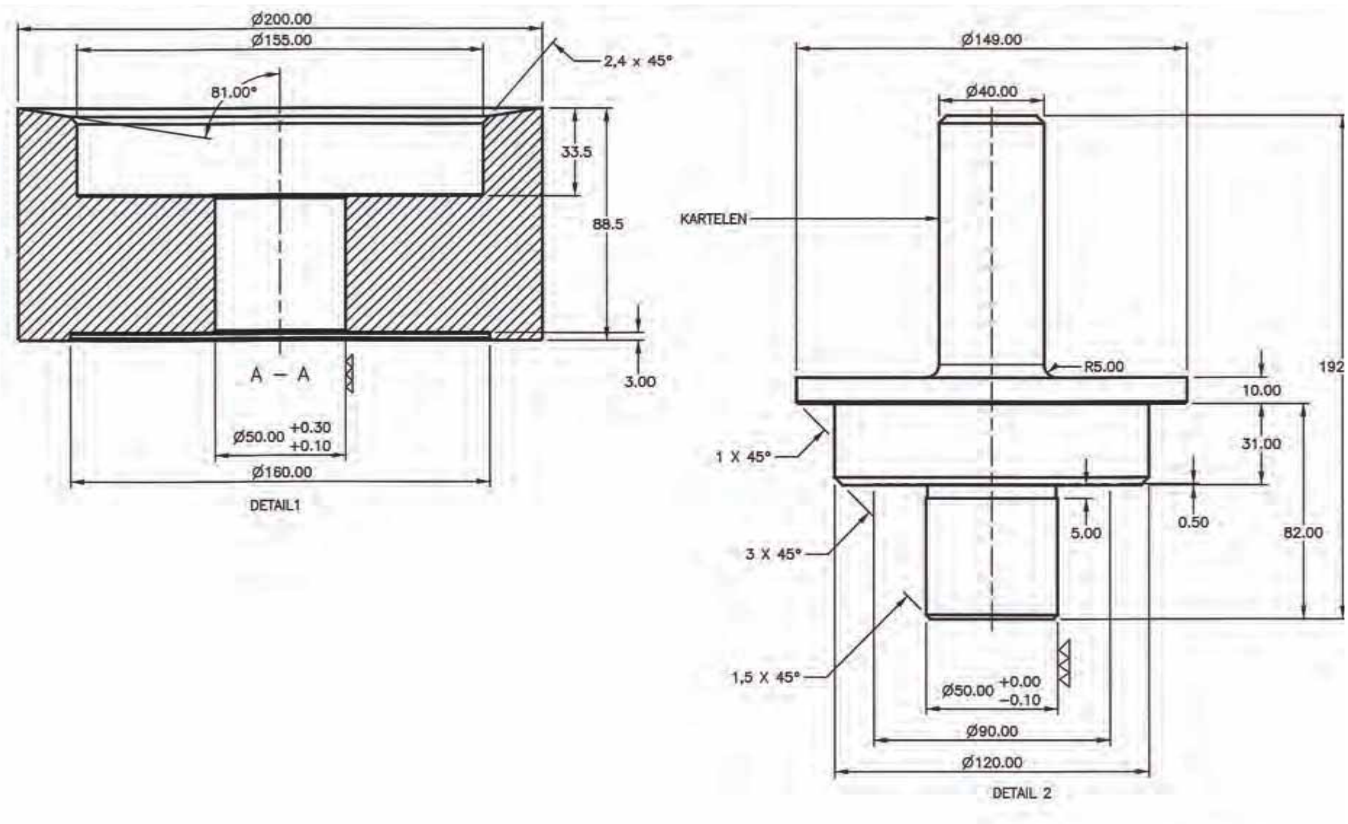
Converter Lifting Hook



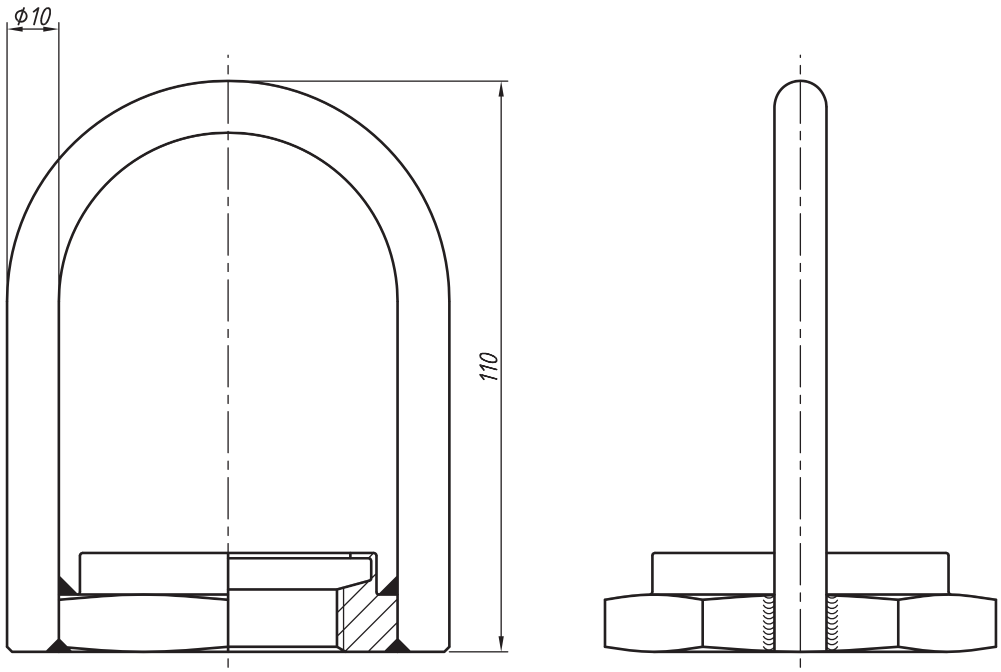
Case Lifting Hook



Oil Baffle Seal Driver



Output Shaft Lifting Hook

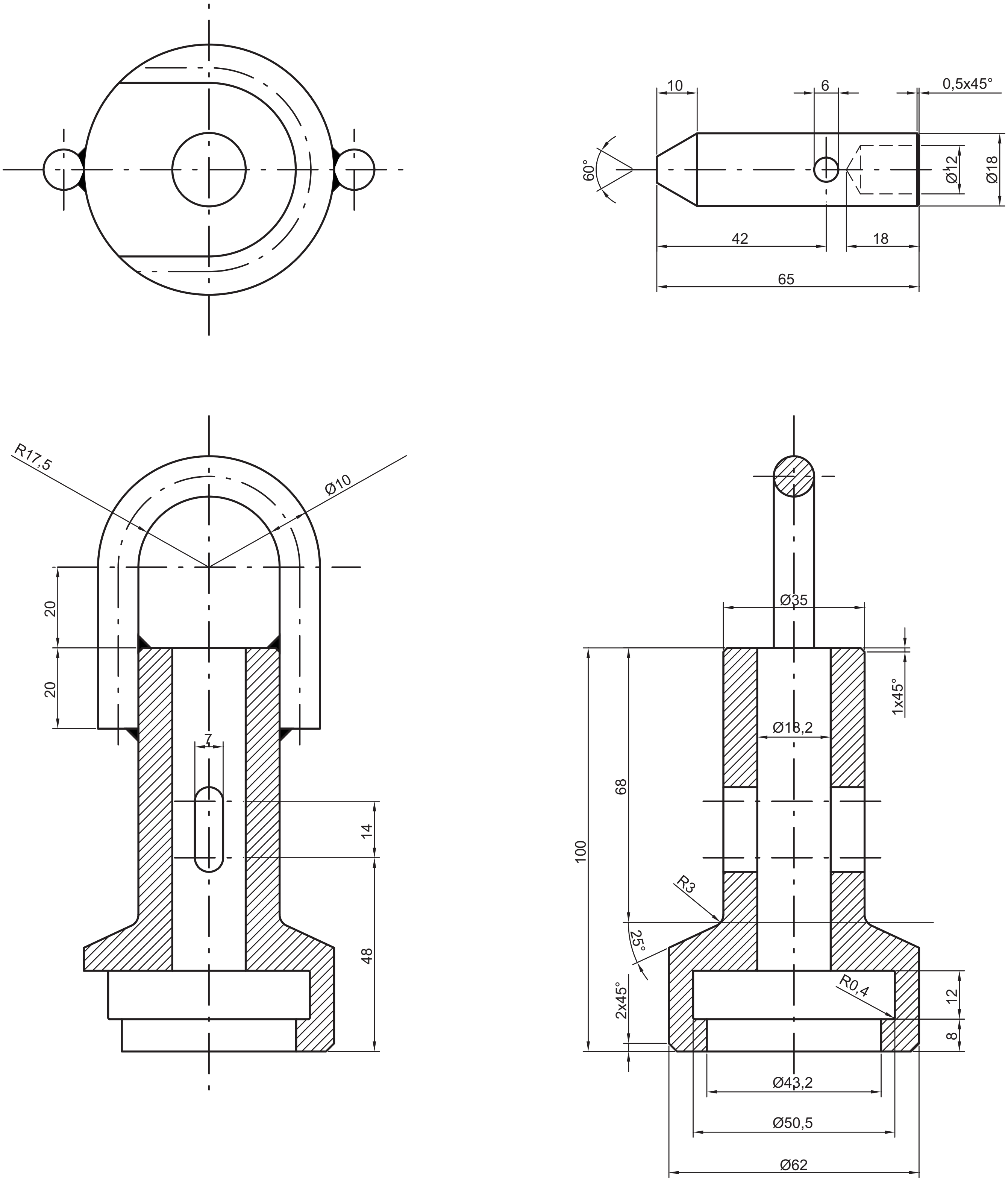


Made from Nut Dana P/N 231639

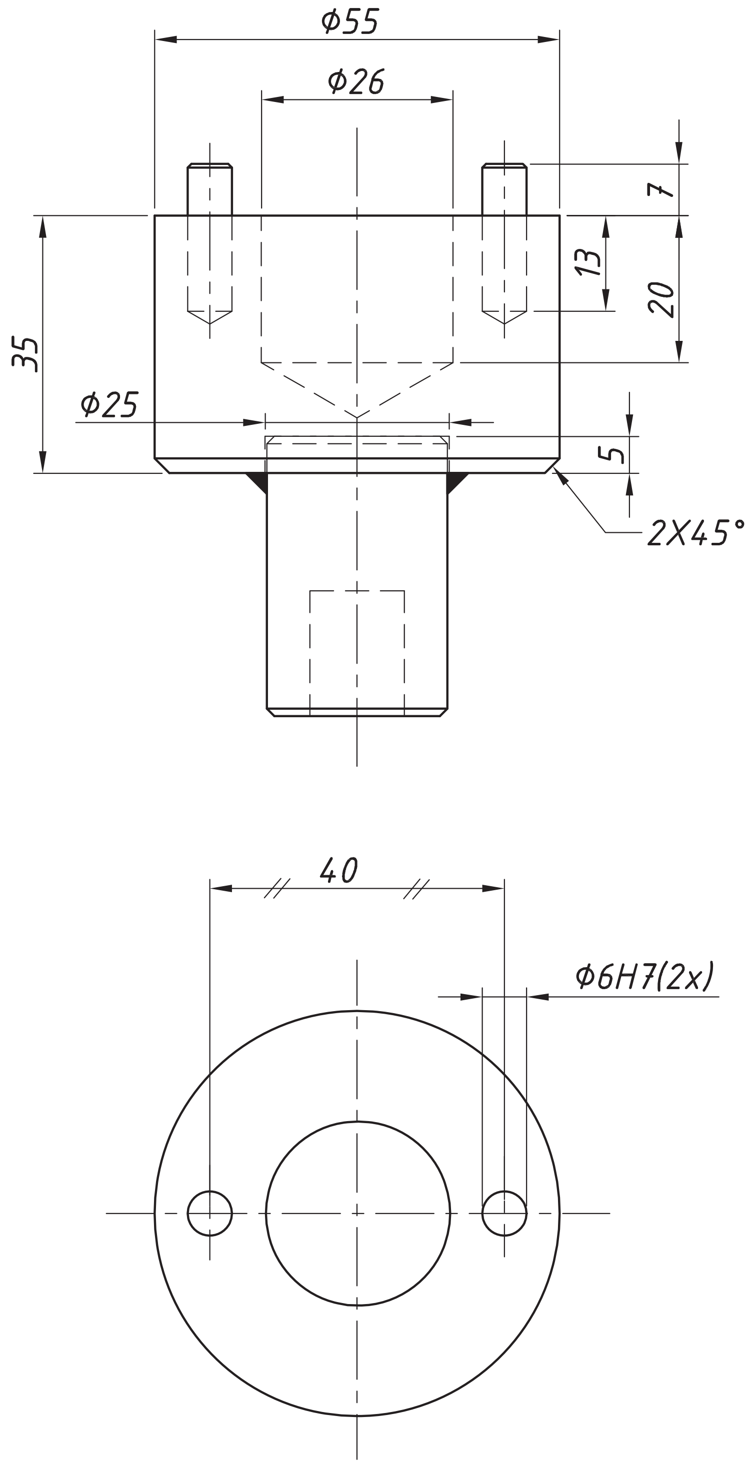
NOTE:

Remove nylon from nut.

2nd/Rev Shaft Lifting Hook



Filter Adaptor Tool



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